FINAL REPORT TO THE DEPUTY ATTORNEY GENERAL

CONCERNING THE 1993 CONFRONTATION AT THE MT. CARMEL COMPLEX

WACO, TEXAS

November 8, 2000

PURSUANT TO ORDER NO. 2256-99 OF THE ATTORNEY GENERAL John C. Danforth SPECIAL COUNSEL

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INTRODUCTION

THIS REPORT contains the findings of the Special Counsel in response to the questions directed to him by Attorney General Janet Reno in Order No. 2256-99, dated September 9, 1999. The questions pertain to the 1993 confrontation between federal law enforcement officials and the Branch Davidians at the Mt. Carmel complex near Waco, Texas. The Report is issued pursuant to Section (e) of Order No. 2256-99 which provides, in relevant part, that the Special Counsel shall submit "to the maximum extent possible . . . a final report . . . in a form that will permit public dissemination."

The Office of Special Counsel has organized the Report in the following format:

- (I) a description of the Issues investigated by the Special Counsel;
- (II) the Conclusions of the Special Counsel;
- (III) a description of the Investigative Methods used by the Special Counsel;
- (IV) a Statement of Facts relevant to the Special Counsel's investigation;
- (V) Exhibits to the text of the Report; and
- (VI) Appendices that include a narrative summary of the relevant beliefs and practices of the Branch Davidians, a summary of expert findings, a chronological table of events, and the reports of experts retained by the Office of Special Counsel.

¹Technically this Report is not final under the regulations governing the Special Counsel because the Special Counsel continues to pursue a single prosecution. This Report does, however, contain all of the findings of the Special Counsel with respect to the questions that the Attorney General posed to the Special Counsel in Order No 2256-99. The Special Counsel will reissue this Report, with appropriate adjustments, upon the completion of the prosecution. At that time, it will become legally final.

The Office of Special Counsel is separately submitting to the Deputy Attorney

General copies of the documents upon which it relied in preparing this Report.²

I. Issues Investigated by the Special Counsel

On September 9, 1999, the Attorney General appointed former United States Senator John C. Danforth as Special Counsel to investigate the 1993 confrontation between federal agents and the Branch Davidians ("Davidians") that resulted in the deaths of four agents of the Bureau of Alcohol, Tobacco and Firearms ("ATF") and at least 82 Davidians.³ Senator Danforth and his staff negotiated the terms of the Order directly with the Attorney General and her staff from September 5 to September 8, 1999. Senator Danforth and the Attorney General agreed that the investigation should determine whether representatives of the United States committed bad acts, not whether they exercised bad judgment.⁴ Therefore, they drafted a very specific Order that identified five principal issues:⁵

²The Department of Justice has advised the Office of Special Counsel that public release of these documents cannot be made until they have been reviewed in accordance with applicable federal law, including the Privacy Act of 1974, 5 U.S.C. § 552a. However, the Department of Justice has advised that public release of this Report by the Deputy Attorney General would not violate the Privacy Act.

³The figure of "at least 82" dead is based upon recovered bodies, including six Davidians killed on February 28, 1993, but excluding two unborn children, one of which was near term. The Office of Special Counsel cannot state with certainty the exact number of deaths because of the extensive burning and commingling of bodies that occurred during the tragic fire on April 19, 1993, especially in the concrete bunker area of the complex where the bodies of most of the women and children were found.

⁴For example, the Office of Special Counsel was not tasked with and will not address the issue of whether it was appropriate for ATF to execute a raid on February 28, 1993, or for the Federal Bureau of Investigation ("FBI") to execute its gas insertion plan on April 19, 1993. These issues require an evaluation of judgment, an evaluation that is outside the scope of the Attorney General's Order.

⁵A copy of Order No. 2256-99 is attached hereto as Exhibit 1. The Order lists six issues to investigate. For ease of organization, this Report has combined the two "coverup" issues into

- (1) whether agents of the United States started or contributed to the spread of the fire that killed members of the Branch Davidian group on April 19, 1993;
- (2) whether agents of the United States directed gunfire at the Branch Davidian complex on April 19, 1993;
- (3) whether agents of the United States used any incendiary or pyrotechnic device at the Branch Davidian complex on April 19, 1993;⁶
- (4) whether there was any illegal use of the armed forces of the United States in connection with the events leading up to the deaths occurring at the Branch Davidian complex on April 19, 1993;⁷ and
- (5) whether any government representative made or allowed others to make false or misleading statements, withheld evidence or information from any individual or entity entitled to receive it, or destroyed, altered or suppressed evidence or information concerning the events occurring at the Branch Davidian complex on April 19, 1993.8

At Senator Danforth's request, the Order of the Attorney General gave Senator

Danforth and his staff the power to prosecute federal crimes concerning the above issues and any

one. In addition, the Order refers to the Mt. Carmel "compound." Certain members of the Branch Davidian group interviewed by the Office of Special Counsel objected to this characterization. In deference to them, this Report refers to their place of residence and the surrounding structures as the Branch Davidian complex.

⁶The first three issues– fire, gunfire and pyrotechnic device– relate only to events occurring on April 19, 1993.

⁷The fourth issue, the use of the armed forces of the United States, encompasses events "leading up" to April 19, 1993. This language specifically permitted Senator Danforth to investigate actions of the military that preceded April 19, 1993. Senator Danforth requested this language so that he could investigate allegations that the armed forces had operated inside the Branch Davidian complex prior to April 19, 1993.

⁸The fifth issue, the "coverup" issue, relates principally to activities that post-date April 19, 1993, although the Office of Special Counsel did investigate whether any actions of April 18 and 19, 1993, constituted an effort to cover up crime scene evidence of the initial ATF operation of February 28, 1993, an issue that is only marginally related to the Attorney General's Order. The Office of Special Counsel uncovered no evidence of acts committed by the FBI to cover up the events of February 28, so this Report does not address that issue further.

criminal attempt to interfere with his investigation. Finally, the Order required that Senator Danforth issue a Final Report and such interim reports as he deems appropriate. This Report updates and supplements the Special Counsel's Interim Report to the Deputy Attorney General dated July 21, 2000.

II. Conclusions of the Special Counsel

The Office of Special Counsel has undertaken an exhaustive investigation into allegations of grave misconduct by employees of the United States government. In essence, the charges are that on April 19, 1993, federal agents caused the fire which destroyed the Branch Davidian complex and killed many Davidians who remained in it, directed gunfire at the complex, illegally employed the armed forces of the United States to assault the complex, and then covered up the alleged misconduct.

The investigation lasted 14 months, employed 74 personnel, and cost approximately \$17 million. The Office of Special Counsel interviewed exactly 1,001 witnesses, reviewed over 2.3 million pages of documents, and examined thousands of pounds of physical evidence. As a result of this effort, the Special Counsel states the following conclusions with certainty:

⁹The Order further indicated that the provisions of 28 CFR §§ 600.4 through 600.10 would apply to the administration of the Office of Special Counsel. Note that certain provisions of the Special Counsel regulations (28 CFR §§ 600.1-3) were omitted from the Charter. Senator Danforth believed that inclusion of these provisions would have indicated that his investigation was purely criminal in nature, which, at least arguably, could have prohibited the public disclosure of part or all of a written report. Instead, Senator Danforth negotiated language indicating that he intended to submit his report in a form that would permit, to the maximum extent possible, public dissemination of his findings.

The government of the United States and its agents are not responsible for the April 19, 1993, tragedy at Waco. The government:

- (a) did not cause the fire;
- (b) did not direct gunfire at the Branch Davidian complex; and
- (c) did not improperly employ the armed forces of the United States.

Responsibility for the tragedy of Waco rests with certain of the Branch Davidians and their leader, Vernon Howell, also known as David Koresh, who:

- (a) shot and killed four ATF agents on February 28, 1993, and wounded 20 others;
- (b) refused to exit the complex peacefully during the 51-day standoff that followed the ATF raid despite extensive efforts and concessions by negotiators for the Federal Bureau of Investigation ("FBI");
- (c) directed gunfire at FBI agents who were inserting tear gas into the complex on April 19, 1993;
- (d) spread fuel throughout the main structure of the complex and ignited it in at least three places causing the fire which resulted in the deaths of those Branch Davidians not killed by their own gunfire; and
- (e) killed some of their own people by gunfire, including at least five children.

While the Special Counsel has concluded that the United States government is not responsible for the tragedy at Waco on April 19, 1993, the Special Counsel states with equal certainty that an FBI agent fired three pyrotechnic tear gas rounds at 8:08 a.m. on April 19, 1993, at the concrete construction pit approximately 75 feet from the living quarters of the Davidian complex. The pyrotechnic tear gas rounds did not start the fire that consumed the complex four hours later.

The Special Counsel has also concluded that certain FBI and Department of Justice officials failed to disclose to the Attorney General, Congress, the courts, counsel for the Davidians, and the public, evidence and information about the use of pyrotechnic tear gas rounds until August 1999. This failure resulted from a combination of the inappropriate handling of evidence and the dereliction of duty by FBI and Department of Justice employees. As more fully set out below, the Special Counsel has concluded that some of these employees also obstructed the investigation.

1. Did agents of the United States start or contribute to the spread of the fire that caused the death of Branch Davidians on April 19, 1993?

Government agents did not start or materially contribute to the spread of the fire.

During the morning of April 19, 1993, several Davidians spread accelerants throughout the main structure of the complex, and started fires in several locations. The evidence indicates that many of the Davidians did not want to escape the fire. Indeed, while government agents risked their lives to save Davidians from the fire, one Davidian tried to re-enter the burning complex to die.

When an FBI agent questioned this Davidian regarding the location of the children, the Davidian refused to answer. A Davidian who exited the complex during the fire stated that he witnessed

¹⁰There is evidence that structural debris, which resulted from an FBI vehicle breaching the complex, interfered with a potential escape route by blocking the trap door leading to an underground bus, which was located on the west end of the complex. (The complex did not line up precisely on an east-west axis, but the Special Counsel uses these directional approximations for ease of reference.) However, the breaching operations also created three avenues of possible exit— at the base of the main tower, at the front door, and on the east side of the chapel.

others make no effort to leave the complex. Another Davidian expressed remorse that she had not perished in the fire with the rest of the group.

The following evidence demonstrates that the Davidians started the fire:

(a) Title III Intercepts.¹¹ Davidian conversations intercepted through the use of concealed listening devices inside the complex from April 17 to April 19 indicate that the Davidians started the fire. An April 17 intercept records Davidians discussing how they could prevent fire trucks from reaching the complex. An April 18 intercept records a conversation between Steven Schneider¹² and other Davidians indicating a conspiracy to start a fire. During that conversation, Schneider joked that another Davidian had always wanted to be a "charcoal briquette." Another Davidian stated that, "I know there's nothing like a good fire" On April 19, between the beginning of the tear gas insertion operation at approximately 6:00 a.m. and approximately 7:25 a.m., the Title III intercepts recorded the following statements: "Need fuel;" "Do you want it poured?;" "Have you poured it yet?;" "Did you pour it yet?;" "David said

¹¹"Title III intercepts" are court-authorized, recorded interceptions of conversations, obtained through the use of concealed listening devices. The content of these Title III intercepts may be publicly released pursuant to order of the United States District Court for the Western District of Texas. In order to obtain accurate transcriptions of the recordings, the Office of Special Counsel utilized the assistance of both its retained expert and its own investigators.

¹²An Office of Special Counsel investigator identified Steven Schneider's voice on the intercepts based on an extensive review of known samples of Schneider speaking. The investigator's voice identification confirmed a prior voice identification made by an FBI Title III monitor who also became familiar with Schneider's voice while monitoring Title III recordings throughout the standoff. The Office of Special Counsel's expert forensic phonetician, Mrs. Elizabeth McClelland, agreed that, on an auditory-phonetic basis, some features of the recorded voices matched known speech samples from Davidians, including Schneider. McClelland cautioned, however, that instrument analysis of the speech signals on the Title III recordings did not produce results from which a forensic speaker identification could be achieved with certainty. See Appendix G.

pour it right?;" "David said we have to get the fuel on;" "We want the fuel;" "They got some fuel around here;" "Have you got the fuel . . . the fuel ready?;" "I've already poured it;" "It's already poured;" "Yeah . . . we've been pouring it;" "Pouring it already;" "Real quickly you can order the fire yes;" "You got to put the fuel in there too;" "We've got it poured already;" "Is there a way to spread fuel in here?;" "So we only light it first when they come in with the tank right . . . right as they're coming in;" "That's secure . . . we should get more hay in here;" "You have to spread it so get started ok?" These statements precede the sighting of fire by several hours, which is further proof that the Davidians intended to set fire to the complex well in advance of actually lighting the fires.

Much closer to the time of the fire, from approximately 11:17 a.m. to 12:04 p.m., Title III intercepts recorded the following statements from inside the complex: "Do you think I could light this soon?;" "I want a fire on the front . . . you two can go;" "Keep that fire going keep it." The only plausible explanation for these comments is that some of the Davidians were executing their plan to start a fire. Transcripts of the Title III intercepts developed by Mr. Chris Mills, an audio expert retained by the Office of Special Counsel, are attached hereto as Appendix G.

¹³These statements, which are intelligible on the enhanced versions of the Title III tapes, provide compelling evidence that the Davidians carefully planned and then systematically set the fire. The Office of Special Counsel also conducted a detailed investigation into allegations that the overhears should have prompted the FBI commander to call off the tear gassing plan when the FBI monitors heard the Title III intercepts indicating that the Davidians intended to start a fire. Having reviewed the tapes and interviewed the relevant witnesses, the Office of Special Counsel concludes that the intercepts were largely incomprehensible until the FBI later enhanced the tapes and, therefore, that the FBI agents monitoring the intercepts did not hear or understand the statements until after the fire.

- (b) Admissions of Branch Davidians. Davidians who survived the fire have acknowledged that other Davidians started the fire. Graeme Craddock told the Office of Special Counsel in 1999 that he observed other Davidians pouring fuel in the chapel area of the complex on April 19, 1993. He further stated that he saw another Davidian, Mark Wendel, arrive from the second floor yelling: "Light the fire." Davidian Clive Doyle told the Texas Rangers on April 20, 1993, that Davidians had spread Coleman fuel in designated locations throughout the complex, although he declined to state who specifically lit the fires.
- (c) Statements of Government Witnesses. Observations by government witnesses support the conclusion that the Davidians started the fire. FBI agents who had the opportunity to observe activity within the Branch Davidian complex on April 19, using field glasses or spotting scopes, saw Davidians engaged in activity which they later concluded to be pouring fuel to start a fire. Some of these sightings were noted contemporaneously by the agents in FBI logs. Also, an FBI agent observed an unidentified Davidian ignite a fire in the front door area of the complex shortly after noon. This observation was also reported contemporaneously.
- (d) Expert Fire Analysis. Fire experts agree that Davidians started the fire. The Office of Special Counsel interviewed the experts who performed the original, on-scene fire investigation and analysis. The Office of Special Counsel also retained two fire experts, one to review the work product of the previous investigators and to examine independently the photographic and physical evidence, and the other to analyze the spread of the fire throughout the complex. In addition, the Office of Special Counsel retained an expert to determine whether the tear gas, a combination of methylene chloride and orthochlorobenzylidenemalononitrile

(commonly referred to as "CS"), reached concentration levels in the complex that were sufficiently high to have caused or contributed to the rapid spread of the fire.¹⁴

Relying upon photographs, records of previous on-site investigative activity (such as the use of an accelerant detection dog), physical evidence, computer models and Forward Looking Infrared ("FLIR") tapes, the experts concluded without question that people inside the complex started the fire in numerous locations throughout the complex. Three of these locations developed into large fires¹⁵ –on the second floor of the southeast corner of the main structure of the complex, at the stage area at the rear of the chapel, and in the kitchen/cafeteria area of the complex. See Appendices D and E. The experts further concluded that the CS and methylene

¹⁴The Office of Special Counsel also questioned federal agents who drove vehicles into the complex and shot tear gas into the complex to determine if they may have accidentally started the fire by knocking over a lantern or by other means. The Office of Special Counsel has determined that they did not start the fire.

¹⁵Ignition times and locations were determined from still photographs, color videos, interpretation of visible images from the FLIR sensor (Vector Data Systems (U.K.) Ltd., Appendix I), and a computer analysis of changes in temperature within the FLIR imagery (Mrs. Lena Klasén, Appendix H) that are not visible to the human eye.

¹⁶The Attorney General's Order asked the Office of Special Counsel to determine not only if federal agents started the fire, but also whether they "contributed to the spread of the fire." Like the other parts of the Attorney General's Order, this portion of the Order was intended to refer to intentional wrongdoing by the government. As to whether government agents committed intentional wrongdoing which contributed to the spread of the fire, the answer is clearly no. The openings in the complex made by the Combat Engineering Vehicles ("CEV's") did allow for greater ventilation, which could have accelerated the spread of the fire in some areas, but the openings were made with the intent to create exits and to deliver tear gas. Moreover, the openings created by the CEV's, and the subsequent accelerated spread of the fire, did not contribute to the deaths of the Davidians. In fact, in most cases, the openings made additional avenues of exit for the Davidians had they wanted to avoid the fire, and some Davidians did use these openings to escape the fire.

chloride inserted into the complex as part of the plan did not start or contribute to the spread of the fire. See Appendix F.

In addition to the allegations that CS gas could have started the fire in the Davidian complex, some have claimed that tear gas is lethal and should not have been used by the FBI at Waco. Indeed, although concluding, "[I]t is highly unlikely that the CS riot control agent, in the quantities used by the FBI, reached lethal toxic levels," the United States House of Representatives Judiciary Committee and the Committee on Government Reform and Oversight issued a report on August 2, 1996, stating:

The presented evidence does indicate that CS insertion into the enclosed bunker, at a time when women and children were assembled inside that enclosed space, could have been a proximate cause of or directly resulted in some or all of the deaths attributed to asphyxiation in the autopsy reports.

Therefore, the Office of Special Counsel believed that it was necessary to investigate thoroughly whether the CS gas used at Waco could have killed any of the Davidians.

As stated in the Introduction, the evidence clearly establishes that the Davidians killed themselves. There is no doubt that they set the complex on fire; they refused to come out of the complex after they started the fire; and they shot themselves. No forensic pathologist who has examined the evidence has found any indication that the tear gas killed any Davidian.

Notwithstanding the overwhelming evidence that the Davidians killed themselves, the Office of Special Counsel notes that one of the toxicologists it retained, Dr. Uwe Heinrich, has concluded that, if people exposed to high levels of CS are not able to leave a room, "there is a distinct possibility that this kind of CS exposure can significantly contribute to or even cause lethal effects."

This opinion is contrary to the expert advice given to Attorney General Reno before she approved the FBI's plan to insert tear gas into the complex. She has consistently stated that her primary concern was whether the tear gas could permanently harm the occupants of the complex, particularly the children. She has stated that had she been told the tear gas could be lethal, she would never have approved the tear gas plan. The expert who advised Attorney General Reno and the FBI on the potential effects of CS gas in April of 1993 told them that the tear gas could not cause death or permanent injury. Based on the then-available literature regarding the effects of CS gas on humans, the expert's advice to Attorney General Reno may have been well-founded at that time. Indeed, no human death resulting from CS has ever been reported in the scientific literature.

The tear gas inserted by the FBI on April 19, 1993, was a liquid aerosol of CS powder dissolved in methylene chloride.¹⁷ Determining the lethality of CS for humans is a very difficult task. Toxicity studies have not involved humans, but rather animals such as monkeys, dogs, and rodents. Therefore, any calculation of the lethality of CS for humans is only based on an extrapolation from the animal studies. Based upon these animal studies, the Office of Special Counsel's toxicologist concluded that extended exposure to high volumes of CS could potentially be lethal.

The following analysis explains why the Office of Special Counsel has concluded that CS, although potentially lethal, was not responsible for the deaths of any Davidians. At some

¹⁷Based upon the report of the Office of Special Counsel expert Dr. George Lucier, the Office of Special Counsel concludes that the amount of methylene chloride in the complex did not reach lethal levels and did not cause the deaths of any Davidians. Some of the Davidians however, could have experienced mild irritation, dizziness and decreased responsiveness to visual and auditory signals from the methylene chloride.

time in the late morning of April 19, 1993, many of the Davidians, including all the children, moved to the concrete bunker in the back of the complex. The bunker was a 20' by 21' room with concrete walls and no windows, located next to the cafeteria. Its only opening was a doorway approximately 4 feet wide. At 11:49 a.m., one of the CEV's penetrated the front of the complex, moving in the general direction of the bunker, and inserted one canister of tear gas into the complex. The CEV was approximately 17 feet away from the bunker when it inserted this tear gas. At 11:50 a.m., the CEV, then approximately 28 feet from the front of the bunker, inserted a second canister of tear gas.

Whether *potentially* lethal levels of CS were reached in the Davidian complex is not known for sure. Some of that tear gas, although no one knows exactly how much, probably entered the bunker. Dr. Heinrich has stated that the lethal effects of CS depend upon the exposed person being prevented from leaving the area of exposure. The evidence indicates that, throughout the gassing operation, many Davidians moved away from exposed rooms, moved and talked freely, and protected themselves with gas masks and wet towels around their faces. There was a doorway to exit the bunker, and people could have left the room. According to the Office of Special Counsel toxicologist, because of the significant discomfort caused by CS, he would fully expect that, unless individuals were forced to stay in the room, any potentially lethal amount of CS would have forced the occupants out of the room long before they could inhale the amount needed to kill them.

Additionally, although there are no human studies, the studies done on laboratory animals indicate that humans would not die immediately following short-term inhalation exposure to high concentrations of CS. Therefore, even if potentially lethal levels of CS had entered the

bunker, and Davidians were holding some of the members in the bunker against their will, there was insufficient time for the CS to kill anyone. The tear gas insertions near the bunker were at 11:49 a.m. and 11:50 a.m. The Davidians started one or more fires in the cafeteria at approximately 12:05 p.m., quickly filling that space with smoke. By 12:14 p.m., the roof of the cafeteria had burned through and the forensic pathologist believes that by this time, everyone in the bunker was dead from either the gunshot wounds or smoke inhalation.

Notwithstanding the clear evidence that the Davidians killed themselves, in light of the findings of the potential lethality of CS, the Office of Special Counsel believes that law enforcement must give very serious consideration to the appropriate circumstances under which CS should be utilized. Therefore, the Office of Special Counsel strongly recommends that law enforcement personnel consider the reports of Dr. Heinrich, Dr. Lucier and Dr. Havens when determining whether to use CS gas in the future.

The Office of Special Counsel also reviewed the decision of the FBI to delay allowing firefighting equipment to arrive at the scene. The Office of Special Counsel has concluded that the Davidians were shooting at outsiders, which would have endangered the lives of any firefighters who approached. In fact, a Title III intercept from April 17, 1993, records Davidians indicating that they intended to prevent firefighters from approaching the complex: "You're definitely right . . . I think all the time he knows it . . . nobody comes in here . . .;" "Catch fire and they couldn't bring the fire trucks and they couldn't even get near us;" "Exactly." Because firefighters could not immediately approach the complex and fight the fire, it was impossible to control or suppress it. Furthermore, the evidence indicates that many of the Davidians did not want to leave the burning building.

Reports of the fire experts retained by the Office of Special Counsel are attached hereto as Appendices D, E and F. Reports of the toxicology experts retained by the Office of Special Counsel are attached as Appendices K and L.

- (e) Medical Analysis. Autopsy and other medical reports on the victims of the fire provide additional information confirming that Davidians started the fire. For example, Raymond Friesen, a Davidian found deceased in the complex after the fire, had very high benzene levels in his system, which may be indicative of inhaling petroleum-based accelerants, and therefore is consistent with the theory that the Davidians spread fuel and started the fire. A surviving Davidian, Clive Doyle, had accelerants on his coat sleeves as well as burn wounds on his hands that the forensic pathologist retained by the Office of Special Counsel believes to be consistent with wounds that could have occurred when his accelerant-soaked hands came in contact with a flame. See Expert Report, Appendix J.
- (f) Physical Evidence. The Office of Special Counsel and its experts conducted a detailed review of the physical evidence that relates to the fire. During its review, the Office of Special Counsel located Coleman and other fuel cans containing numerous puncture marks.

 Expert tool mark examiners confirmed that someone had deliberately punctured several of the cans— a common tactic among arsonists who wish to spread fuel. Investigators also found a handmade torch among the debris in the kitchen/cafeteria, one of the fire's points of origin. An accelerant canine searched the scene from April 23 to 27, 1993, and identified accelerants in areas where the FLIR tapes and other evidence indicate that the fires started. The presence of these accelerants was later confirmed by lab analysis of portions of the remains of the building. Lab

analysis also found accelerants on clothing and shoes of Davidians. See Expert Reports, Appendices D and M.

(g) Beliefs of the Davidians. The teachings of Koresh are consistent with the overwhelming eyewitness and physical evidence that the Davidians started the fire. The Office of Special Counsel interviewed Davidians, religious experts and writers to determine whether the Davidians would start a fire for any reason. Based on these interviews, the Office of Special Counsel concluded that the Davidians considered death by fire justified— even desirable— under circumstances in which they were under attack by forces that they considered to be evil, including the government.

Koresh taught the Davidians that fire would "transcend" or "translate" them immediately to heaven. Davidian survivors Marjorie Thomas and Graeme Craddock specifically recalled Koresh teaching that fire is an acceptable means of death for Davidians. Thomas remembers Koresh stating during Bible study that fire would transcend the Davidians to heaven during the "battle" with Babylon, and that Koresh considered the U. S. government to be Babylon. Davidian Kathy Schroeder recalled that, shortly after the confrontation with ATF on February 28, 1993, Koresh told the Davidians that he had a dream that the Davidians would burn in a great fire, their skin would burn off, and they would "transcend" to heaven. The Davidians referred to their complex as "Ranch Apocalypse" and, on April 16, 1993, several federal agents observed a Davidian hold a sign outside a window of the complex that read "the flames await: Isaiah 13."

An alternative explanation, that of Dr. J. Phillip Arnold of Houston's Reunion

Institute, is that Koresh may have ordered the Davidians to set the fires as protection from government forces in a manner similar to the protection discussed in the Book of Daniel, with the

story of Shadrach, Meschach and Abednego in the fiery furnace. Dr. Arnold further stated that Koresh and the Davidians would not have run from the fire, but rather may have viewed the fire as a fulfillment of prophecy.

Whether the Davidians set the fires to cause their deaths and transcend to heaven, or set them in an attempt to create a shield of fire, once the fire was set, it became a fulfillment of Koresh's prophecy and, in accordance with his religious teachings, was an acceptable and even desirable way of dying for the Davidians. Consequently, there exist strong bases in the Davidians' religious beliefs and conduct to support the conclusion that the Davidians started the fire on April 19, 1993. A more detailed discussion of the beliefs of the Davidians as they relate to the issues presented in this Report is contained in Appendix A.

As the foregoing discussion indicates, the evidence is conclusive that the Davidians started the fire. While actions of the government may have contributed incidentally to the spread of the fire, these actions (or inactions) did not cause the tragic loss of life on April 19, 1993.

2. Did agents of the United States direct gunfire at the Branch Davidian complex on April 19, 1993?

No employee of the United States fired a gunshot at the Branch Davidian complex on April 19, 1993.¹⁸ To the contrary, while the Davidians fired upon government agents throughout the morning of April 19, government agents did not return gunfire. Indeed, the FBI

¹⁸For the purposes of this report, the term "gunshot" does not encompass the firing of tear gas rounds from M-79 grenade launchers, which occurred repeatedly at Waco on April 19, 1993.

had the authority to return fire under the law and its deadly force policy, but the agents acted with restraint and did not do so.

In arriving at these conclusions, the Office of Special Counsel relied upon the following evidence:

(a) FLIR Testing and Analysis. Virtually the only evidence cited by those claiming government agents fired shots into the complex on April 19, 1993, is the FLIR videos recorded by the FBI Nightstalker aircraft from approximately 10:42 a.m. to 12:41 p.m. on that day. In fact, however, this evidence strongly supports the conclusion that no agent of the United States fired a shot on April 19.

The FLIR tapes show 57 flashes, emanating principally from alleged Davidian positions inside or on top of the complex. Eighteen of the flashes occur on the back side of the complex, with some occurring around government vehicles that were operating near the complex. During the past three years, representatives of the Davidians and several independent experts retained by the media and Congress have concluded that gunfire could have caused or did cause these flashes. The FBI and its experts have claimed that the flashes are reflections or "glint" coming from debris scattered in and around the complex.

The Office of Special Counsel retained two teams of experts to analyze the FLIR tapes from April 19. Working with the United States district court judge in the civil litigation brought by some of the Davidians and their families against the United States government, the Office of Special Counsel and its expert, Vector Data Systems (U.K.) Ltd., conducted a field test of FLIR technology at Fort Hood, Texas on March 19, 2000. The purpose of the test was to identify the thermal signature, if any, that gunfire and debris would leave on a FLIR recording.

The Office of Special Counsel conducted the test under a protocol agreed to and signed by both the attorneys and experts for the government and the attorneys and experts for the Davidians and their families. The protocol identified the FLIR equipment, the weapons, and the other conditions that would best approximate the scene at Waco in 1993.

Based on a detailed analysis of the shape, duration and location of the 57 flashes noted on the 1993 FLIR tapes, and a comparison of those flashes with flashes recorded on the March 2000 FLIR test tape, Vector Data Systems (U.K.) Ltd., concluded with certainty that each of the flashes noted on the 1993 tapes resulted from a reflection off debris on or around the complex. These conclusions are supported by color photographs which show the reflective debris at the exact location of many of the flashes noted on the 1993 tapes.

Mrs. Lena Klasén, a second independent expert retained by the Office of Special Counsel, concluded that thermal activity caused by human movement or motion did not exist near or around the area of the flashes noted on the FLIR tapes. She further concluded that photographs taken during the tear gas insertion show no people at or near the points from which the flashes emanated. Mrs. Klasén also performed a three-dimensional analysis of the reflection geometry existing at the complex on April 19, 1993. This analysis accounted for the Nightstalker's movement, the position of the FLIR sensor, and the changing angle of the sun. Based on this analysis, Klasén, like Vector, concluded that the flashes on the 1993 tapes were from debris. The FLIR test and the expert analyses prove conclusively that the FLIR tapes do not evidence gunfire directed at the Davidians from government positions. Copies of the Reports of the FLIR experts retained by the Office of Special Counsel are attached hereto as Appendices H and I.

- (b) Ballistics Testing. The ballistics expert retained by the Office of Special Counsel further supports the conclusion that there was no government gunfire on April 19, 1993. The Office of Special Counsel conducted ballistics testing on 36 shell casings found at the "Sierra-1" government sniper position to determine if FBI agents fired these shots. The expert concluded with certainty¹⁹ that these casings came from weapons the Office of Special Counsel identified as ATF weapons fired on February 28, 1993.²⁰ The casings do not, therefore, evidence FBI gunfire on April 19. A copy of the Report of the ballistics expert retained by the Office of Special Counsel is attached hereto as Appendix M.
- (c) Statements of Davidian Witnesses. The interviews of Davidians further establish that no government agent fired on April 19. The Office of Special Counsel interviewed 13 Branch Davidians, six of whom were in the complex on April 19, 1993.²¹ Attorneys and investigators for the Office of Special Counsel questioned each of these witnesses in detail about the standoff. None of the Davidians who were in the complex on April 19 indicated that he or she saw or heard government gunfire, nor did any Davidian provide other evidence that the government fired at the complex or at the Davidians.

¹⁹After the Office of Special Counsel conducted the ballistics tests, counsel for the parties in the civil litigation also conducted similar testing. Experts for both the plaintiffs and the defendants reached identical conclusions— that the shell casings from the Sierra-1 sniper position did not match the FBI weapons of April 19. As a result, counsel for the Davidians in the civil litigation dropped their claims against FBI sniper Lon Horiuchi, who had been stationed at Sierra-1.

²⁰The Office of Special Counsel could not test four additional shells found near Sierra-1 (three .45 caliber and one .22-250 caliber). The casings appeared to be old, predating the standoff, and not of the manufacture or caliber utilized by the FBI or ATF.

²¹A total of nine Branch Davidians survived the fire but only six of them agreed to speak with the Office of Special Counsel.

The evidence indicates that the Davidians who died from gunfire either committed suicide or were shot by other Davidians. One former Davidian, Kiri Jewell, testified before Congress that Koresh had taught her, when she was 10 years old, how to use a gun to kill herself. Moreover, Dana Okimoto, a former Davidian, reported to the government on March 3, 1993, that Koresh had instructed his followers that, if he died before they did, the women should kill themselves or receive assistance from the men, who were to go on a shooting spree before they died. Title III intercepts indicate that on March 16, 1993, a Davidian, possibly Koresh, discussed committing suicide by shooting himself. These statements further support the conclusion that the Davidians shot themselves and did not die as the result of government gunfire.

(d) Statements of Government Witnesses. The United States government has maintained consistently since April 19, 1993, that no government agent fired a single shot at the Davidian complex on April 19. Every government witness interviewed by the Office of Special Counsel confirmed this contention. The Office of Special Counsel conducted detailed interviews with federal government personnel who were in the vicinity of the complex on April 19, 1993, or otherwise involved with the Waco incident. These included 517 FBI personnel, five United States Secret Service agents, 56 ATF agents, and 92 members of the active duty armed forces of the United States, including members of the Army Special Forces. The Office of Special Counsel also interviewed state and local government officials, including 36 members of the Texas and Alabama National Guards, and 43 Texas Rangers. The Office of Special Counsel informed certain key witnesses that the charter of the Office of Special Counsel permitted criminal prosecution of anyone who lied to representatives of the Office of Special Counsel, and, where

appropriate, that the Office would in fact prosecute any person found to have made false statements to its investigators.

Office of Special Counsel attorneys and investigators asked government representatives who were present at the complex on April 19 (or otherwise involved in the Waco confrontation) not only whether they fired weapons, but also whether they saw any other government person fire a weapon, and whether they even heard discussion or rumor that any government agent engaged in gunfire. Not a single one of the hundreds of government witnesses stated that he or she had any knowledge suggesting that any government agent fired at the Davidians on April 19.

Numerous government witnesses did, however, see or hear gunfire emanating from the complex toward government positions at various times during the morning of April 19. In addition, shortly after the start of the fire, at least four witnesses heard rhythmic bursts of gunfire coming from within the complex, which is consistent with the conclusion that the Davidians were deliberately shooting each other. The eyewitness accounts of government personnel, therefore, indicate that the government did not fire at the Davidians, but that the Davidians fired at the government and shot themselves.

(e) Statements of other people claiming that the government engaged in gunfire.

Several other parties have claimed that the government engaged in gunfire on April 19, but none of them provided credible evidence to support this contention. The Office of Special Counsel interviewed filmmakers, writers, and advocates for the Davidians. None of them had witnessed any government gunfire on April 19. Further, none of them provided evidence supporting their contention of government gunfire on April 19, other than the flashes that appear on the 1993 FLIR

tapes and the shell casings found at the Sierra-1 sniper position.²² As stated above, the FLIR tapes and shell casings do not provide evidence of government gunfire on April 19.

(f) Polygraph Testing. Polygraph testing reinforces the conclusion that no government agent fired a shot on April 19.²³ During the course of conducting classified interviews with members of the Army Special Forces, the Office of Special Counsel obtained conflicting information on the exact whereabouts of one Army Special Forces member who was at Waco on April 19, 1993, although no witness suggested that this soldier had entered the perimeter of the complex or fired a weapon. This conflicting testimony also surfaced in the civil litigation between the Davidians and their families and the government, which led to speculation among counsel for the Davidians and their families and the press that this individual may have fired a weapon into the complex. Consequently, the Office of Special Counsel engaged the services of two polygraph examiners from the United States Postal Inspection Service ("USPIS") to help determine whether this individual had entered the perimeter of the complex at any time or fired a

²²Some of them provided names of alleged witnesses, but either those witnesses could not be located because too little information was given to find them, or the information provided by the witnesses did not support the contention that the government fired into the complex on April 19.

²³In instances where conflicts in testimony occurred, or where there was no other corroborative evidence, the Office of Special Counsel made limited use of polygraph testing. Polygraphs are frequently used in law enforcement investigations. However, the reliability of polygraph results is often disputed. Indeed, due to their possible lack of reliability and significant potential prejudicial effect on juries, the majority of courts do not permit polygraph results to be introduced as evidence. Nevertheless, polygraphs are an investigative tool and the Office of Special Counsel in its effort to seek the truth utilized polygraphs as such. In fairness to the individuals who voluntarily took polygraphs, and in order not to overemphasize their value, the Office of Special Counsel will only report the polygraph results which it ultimately could corroborate with independent evidence of significant probative value.

weapon on April 19. These examiners concluded that this individual was "not deceptive" in saying that he neither entered the perimeter nor fired a weapon at the complex on or before April 19.

documentary record relating to events of April 19, 1993. The documents have included FBI sniper logs, FBI "302" memoranda of interviews, and handwritten notes of meetings. Only one document— a June 2, 1993, FBI 302 memorandum of an interview of FBI Special Agent Charles Riley— contained a statement²⁴ that could be interpreted to mean that a government agent fired on the complex. When interviewed, Riley stated to the Office of Special Counsel that the FBI 302 (which he did not author and did not review at the time) should have stated only that he heard agents stationed at Sierra-1 report gunfire emanating from the complex. Riley noted further that he had corrected the June 2, 1993, 302 memorandum by authoring his own 302 memorandum on November 19, 1996, after the FBI brought the erroneous statement to his attention.²⁵ Consistently, FBI logs of the activity on April 19 indicate no government gunfire, but they record numerous instances of Davidian gunfire.

(h) Videos, Photographs and Recordings. The videos taken by witnesses and the media on April 19 do not indicate government gunfire.²⁶ None of the thousands of photographs

²⁴The 302 states: "SA Riley related that he heard shots fired from Sniper 1 position."

²⁵The author of the Riley 302 also told the Office of Special Counsel that she may have misinterpreted what Agent Riley said when she drafted it. Moreover, the FBI 302's of the other agents who were with Agent Riley at the Sierra-3 sniper position on April 19 make no mention of government gunfire.

²⁶The film *Waco: A New Revelation* portrays video of a helicopter allegedly shooting at the complex on April 19. Vector Data Systems (U.K.) Ltd., the Office of Special Counsel's

from April 19 shows people in the places from which government gunfire allegedly emanated. The Title III intercepts do, however, contain sounds that may be consistent with Davidians firing at government agents from within the complex.²⁷ Video taken by an FBI agent also contains audible evidence of gunfire coming from inside the complex at the time of the fire.²⁸

(i) Autopsy/Pathology Results. Autopsy reports and anthropological work support the conclusion that those Davidians who died of gunshot wounds were killed by other Davidians, not by the government. The 1993 pathology studies concluded that at least 20 Davidians²⁹ were shot and one was stabbed³⁰ on April 19. According to the anthropological work, five of the victims were children under the age of 14. The 1993 studies indicated that many of those who

independent expert, has determined that the flashes shown in the film are merely reflected sunlight, and that the helicopter doors were not even open to permit gunfire from the aircraft.

²⁷When the Title III intercept recorded sharp or loud sounds, the sound recorded on the tape falls and then recovers. This "fall and recovery" is caused by the machine's automatic gain control ("AGC"). Whenever a loud sound that exceeds its maximum recording level is received by the recording machine, the AGC prevents the signal from overloading and distorting the tape. Many of these "fall and recovery" events occur on the intercept recordings. In fact, at 6:05 a.m., the same time HRT reported receiving gunfire from the complex, the Title III listening devices recorded such events inside the complex.

²⁸The Office of Special Counsel audio expert, Mr. Chris Mills, concluded that based on his experience the sharp "cracks" recorded on FBI video tape #1050236 sound to the human ear and look spectrographically like gunshots. However, because no recording of the exact weapon and ammunition being fired exists for forensic comparison, it is not possible to prove with absolute certainty that the sharp "cracks" are in fact gunshots. He further concluded that it is impossible to determine whether the ammunition is being discharged from a firearm or exploding involuntarily due to the heat of the fire.

²⁹The figure "at least 20" is used because the forensic pathologists could not rule out gunshot injuries for several of the Davidian adults and children due to the extensive damage to their bodies by the fire.

³⁰The only stabbing victim, three-year old Dayland Gent, was stabbed in the chest.

died of gunshot injuries were shot in the head or mouth, which is consistent with suicide or execution by the Davidians. Furthermore, information provided to the Office of Special Counsel by those who conducted the 1993 studies indicates that none of the Davidians was shot with a high velocity round³¹ on April 19, which would be expected had they been shot from outside of the complex by government sniper rifles or other assault weapons.

The Office of Special Counsel tested these conclusions thoroughly. While the bodies of the deceased Davidians are no longer available to be examined, the Office of Special Counsel did retain a forensic pathologist with specific expertise in gunfire deaths to conduct a thorough review of the 1993 autopsy reports, the extensive photographic and X-ray record from the initial pathology studies, the DNA findings, and the anthropological work of the Smithsonian Institution on the Davidians' remains. The Office of Special Counsel also interviewed the members of the 1993 pathology team. Based upon this expert analysis and interviews with the original pathology team and the anthropologists from the Smithsonian Institution, the Office of Special Counsel has confirmed that 20 Davidians died of gunshot wounds on April 19. While it is impossible to determine what type of round killed some of the victims, several of the Davidians who died on April 19 had residual evidence indicating that they had been shot with low velocity rounds, either within inches of or in contact with their heads. None of the Davidians who died on April 19 displayed evidence of having been struck by a high velocity round. The expert retained by the Office of Special Counsel concluded that many of the gunshot wounds "support selfdestruction either by overt suicide, consensual execution (suicide by proxy), or less likely, forced

³¹Dr. Doug Owsley of the Smithsonian Institution informed the Office of Special Counsel that none of the gunshot injuries to the head exhibited evidence of the damage which would be caused by "high velocity rounds."

execution." Therefore, the autopsy evidence, while not conclusive as to the gunfire issue for all victims, fully supports the theory that the Davidians shot themselves. A copy of the report filed by the pathologist retained by the Office of Special Counsel is attached hereto as Appendix J.

- (j) Tactical Analysis. The Office of Special Counsel also discussed with several witnesses the tactical implications of the allegations that government agents fired guns on April 19 in the manner alleged. The allegations are that government agents exited their armored vehicles in close proximity to the complex, thereby exposing themselves to Davidian gunfire from fortified and elevated Davidian positions within the complex. To have done so would have unreasonably and unnecessarily risked the agents' lives. For example, FBI snipers at one point observed a .50 caliber weapon high in the tower trained directly on their sniper position. As one FBI agent said, being on foot without the cover of an armored vehicle on April 19 under such circumstances "would be sheer madness."
- (k) Lack of Evidence of Ill Motive. The theory that the government deliberately shot or otherwise harmed the Davidians runs contrary to the overwhelming evidence, before, during, and after the fire, that the government officials occupied themselves with resolving the standoff in a peaceful manner that would preserve life if at all possible. FBI agents negotiated patiently with the Davidians for 51 days. They developed their tactical plan with input from behavioral psychologists and doctors whose paramount concern was the safety of the children in the complex. They had doctors located at forward positions near the complex on April 19, including a doctor at the Sierra-2 sniper position and additional medical support at a location near the intersection of roads (the "T-intersection") outside the complex, waiting to provide the

Davidians medical assistance. The FBI also set up a field hospital. Military doctors and law enforcement medics treated all nine of the Davidians who escaped on April 19.

One FBI agent even risked his life by going into the complex to rescue a Davidian who had exited and then ran back into the burning complex. The Davidian resisted the agent's efforts to pull her from the fire, but the agent saved her. Former FBI Director William Sessions provided compelling testimony before Congress in 1993 describing the acts of FBI agents, not only in rescuing Davidians from the burning complex, but also in attempting to rescue Davidians whom the FBI hoped had escaped into an underground bus near the complex. Agents, including HRT commander Richard Rogers, waded into the concrete construction pit, waist deep in water containing human waste and rats, in an unsuccessful effort to find children in the underground bus. It is simply not credible to suggest that while agents on the front side of the complex were risking their lives to rescue the Davidians, other agents on the back side were shooting at them to pin them in the burning structure.

In summary, those claiming that government gunfire did occur have presented an unsupportable case based entirely upon flawed technological assumptions. The FLIR tapes and testing, witness interviews, including those of Davidians, documentary evidence, audio and video evidence, photographs, autopsy reports, polygraph examinations, ballistics testing, and basic tactical and behavioral considerations provide conclusive evidence that no agent of the United States fired gunshots at Waco on April 19, 1993.³² The eyewitness evidence and physical

³²During the late afternoon or early evening hours of February 28, Davidians Michael Dean Schroeder, Norman Allison, and Woodrow Kendrick, attempted to gain entry into the Davidian complex. They approached the complex from the rear or black side of the complex in an area commonly referred to as the Perry Barn or Perry Barn catch pen. The Davidians were confronted by a group of 14 ATF agents who were attempting to withdraw from the area. A

evidence are equally overwhelming that the Davidians shot repeatedly at the government on April 19 and that 20 Davidians either committed suicide or were shot by other Davidians as the fire broke out just after noon on April 19.

3. Did agents of the United States use an incendiary or pyrotechnic device at the Branch Davidian complex on April 19, 1993?

An FBI agent shot three pyrotechnic military tear gas rounds at the plywood covering of the concrete construction pit³³ on the west or "green" side of the complex at approximately 8:08 a.m. on April 19, 1993.³⁴ The rounds failed to penetrate the covering,

shootout ensued during which Schroeder fired at least 18 shots at the agents. Schroeder was killed, Allison was arrested, and Kendrick escaped. Since the death of Schroeder, allegations have been made that Schroeder may have been wounded during the initial shootout and subsequently executed by ATF agents before the agents completed their withdrawal. The theory of Schroeder's execution is based upon the claim that Schroeder died from two gunshot wounds to the back of the skull. A review of the autopsy results of Schroeder by an expert retained by the Office of Special Counsel does not support this claim. Although Schroeder suffered two entry gunshot wounds to the skull, both wound tracks indicate Schroeder was facing forward at the time he was shot, which is consistent with a gun battle, not an execution. The two entry wounds are in the front of his head. The projectiles exited from the rear of his head. The autopsy results support the statements and subsequent criminal trial testimony of the ATF agents involved in this confrontation and are not, therefore, indicative of the alleged execution-style shooting.

³³This structure is alternatively referred to as a construction pit and a tornado shelter by many commentators and witnesses. Some also refer to it as a bunker, which has a tendency to confuse this structure with the storage area below the tower inside the complex, which is also referred to as a bunker by numerous sources. For the purposes of this Report, the Office of Special Counsel will refer to the structure at which the FBI fired military tear gas rounds as the concrete construction pit and the storage area within the complex as the concrete bunker.

³⁴The rounds were pyrotechnic but not incendiary. An incendiary round is designed to start a fire. A pyrotechnic round is not designed to start a fire, but contains a composite of materials which burn, creating heat which can start a fire under certain conditions. The FBI has advanced an argument that military tear gas rounds of the type fired by the FBI at the concrete construction pit on April 19, 1993, are not pyrotechnic. Because this tear gas was delivered with a charge that burns, the Office of Special Counsel rejects the FBI's contention. Military tear gas

bounced off, and landed harmlessly outside the living quarters of the complex. There is no evidence that any government agent fired a pyrotechnic device at the living quarters of the Davidians, nor is there any evidence that any government agent fired pyrotechnic devices after 8:08 a.m. Because the FBI fired the pyrotechnic tear gas rounds nearly four hours before the fire started, at a concrete construction pit partially filled with water, 75 feet away and downwind from the main living quarters, the pyrotechnic tear gas rounds did not start or contribute to the spread of the fire. In support of these conclusions, the Office of Special Counsel relied upon the following evidence:

(a) Witness Interviews and Statements. Members of the FBI's Hostage Rescue

Team ("HRT") have repeatedly acknowledged that one member of the HRT fired pyrotechnic tear
gas rounds on April 19 in an attempt to penetrate the concrete construction pit. In November

1993, the agents who knew that the rounds had been fired discussed their use with the Department
of Justice prosecution team which was preparing to prosecute certain of the surviving Davidians.

The interview notes taken and trial summaries prepared by prosecution team members clearly
reflect discussion of "military" tear gas rounds fired at the concrete construction pit. The notes
reflect that a witness described these rounds (incorrectly) as incendiary. Also in 1993, an FBI
pilot told investigators that he had heard radio transmissions on the morning of April 19
discussing the use of a "military round" at the concrete construction pit. In February 1996, the
HRT again confirmed the use of pyrotechnic military tear gas rounds in response to an inquiry
from the FBI's Office of General Counsel made during the course of the civil case brought by the

rounds are clearly pyrotechnic in nature, as numerous government documents (including the FBI's own Manual of Investigative Operations and Guidelines) and witnesses acknowledge.

Davidians and their families against the government. In 1999 and 2000, HRT agents openly acknowledged using the military tear gas rounds to the Office of Special Counsel.

(b) Photographic and Video Evidence. News footage obtained by the Office of Special Counsel shows FBI Special Agent David Corderman firing pyrotechnic tear gas rounds at the concrete construction pit on the west side of the complex. Film and video footage show a white cloud of tear gas emanating from the area around the concrete construction pit immediately thereafter. An aerial photograph also shows a white cloud around the concrete construction pit, which is a distinctive feature of the type of pyrotechnic tear gas round fired by the HRT. The FLIR tapes contain audio of the conversation at 7:48:52 a.m. in which HRT commander Rogers gave permission to fire these rounds and the conversation at 8:08 a.m. in which the HRT Charlie Team Leader notified Rogers that a member of his team had fired rounds, which had hit the concrete construction pit and bounced off. All of these sources indicate that the FBI fired the pyrotechnic rounds early in the morning, away from the living quarters of the complex.

(c) Physical Evidence. The Texas Rangers placed one expended military tear gas shell that they found during the crime scene search in an evidence locker maintained by the Rangers until the United States District Court for the Western District of Texas ordered the transfer of the evidence to the federal courthouse at Waco. A Texas Department of Public Safety photographer took a photograph of an expended military tear gas projectile on April 30, 1993. This projectile is missing, 35 but the photograph is with the Rangers' evidence at Waco. In addition, FBI explosives expert Wallace Higgins told the Office of Special Counsel that he saw

³⁵The photographer's log indicates that the evidence search team originally found the projectile approximately 200 yards northwest of the water tower, a location consistent with Corderman's description of the angle at which he shot.

two other pyrotechnic tear gas projectiles on or about April 20, 1993,³⁶ adjacent to the concrete construction pit. None of the three projectiles was logged into evidence by the Rangers, and the Office of Special Counsel has not located them.

(d) Polygraph Testing. Special Agent Corderman voluntarily submitted to and passed a polygraph test. The testing confirmed the Office of Special Counsel's conclusion that Agent Corderman was truthful in saying that he fired pyrotechnic tear gas rounds only at the concrete construction pit and not at the living quarters of the complex.

(e) Shaped Charge Allegation. The Office of Special Counsel also investigated allegations made by a filmmaker and a former United States Army Special Forces soldier (who was not at Waco on April 19, 1993) that government operatives allegedly entered the complex and placed explosive devices, known as shaped charges, on the concrete bunker at the complex and a propane tank near the tower. Those alleging that the government placed the shaped charges within the complex claim that the massive explosion that occurred during the fire at 12:26 p.m. on April 19 was the detonation of one of the shaped charges. They also point to photographs taken after the fire which show a hole in the roof of the concrete bunker, which they claim resulted from the detonation of the shaped charge.

The Office of Special Counsel found these allegations totally meritless. Experts retained by the Office of Special Counsel concluded that the explosion seen at 12:26 p.m. is a propane tank exploding due to heat from the fire. See Appendices F and N. Notwithstanding the

³⁶The spent cartridge, which would likely be found near the site where it was fired, is commonly called a "shell" or a "shell casing." The used "projectile" would be found near the target. In this report, the Office of Special Counsel will use the term "round" to describe the whole device, the term "shell" to describe the spent cartridge, and the term "projectile" to describe what is actually shot at the target.

near tactical impossibility of placing shaped charges at the locations alleged, the Office of Special Counsel and its experts analyzed the physical evidence relating to the hole in the concrete bunker and determined: (1) the debris remaining near the hole in the roof is inconsistent with the use of shaped charges or similar highly explosive devices; (2) none of the bodies recovered from the bunker presents evidence of a blast injury; (3) the metal rebar from the bunker is not covered with residue from a shaped charge; and (4) fragments from hand-grenades (which the Davidians had in their arsenal) are spread across the roof of the concrete bunker. Based upon this and other evidence, the Office of Special Counsel and its experts concluded that the hole in the concrete bunker was caused by a combination of heat damage and a low-order grenade detonation. See Appendices E and N. The grenade detonation was also caused by the heat of the fire. Significantly, counsel for the families of the Davidians who perished on April 19 did not pursue the allegation that the government used shaped charges against the Davidians. See Expert Analysis, Appendix N.

4. Was there any illegal or improper use of the armed forces of the United States in connection with events leading up to the deaths of the Branch Davidians on April 19, 1993?

The Office of Special Counsel investigated allegations that members of the armed forces of the United States violated the law by participating directly in the Waco law enforcement operation. Allegations made against the armed forces included claims that its members shot at the Davidians from helicopters on February 28, 1993, infiltrated the complex during the standoff, placed explosive devices in the complex, offered to kidnap Koresh, and shot at the Davidians from positions around government vehicles on April 19, 1993. These allegations proved entirely meritless.

The armed forces of the United States³⁷ did not violate any civil or criminal statute in connection with their activities at Waco in 1993. While the armed forces of the United States provided extensive support for law enforcement agencies, including reconnaissance, equipment, training, advice, and medical assistance, they were careful in their conduct and well-advised legally as they determined exactly what support to provide.³⁸ In fact, in at least two instances, law enforcement agencies solicited assistance from the armed forces that the armed forces either rejected or scaled back due to concerns about remaining within the bounds of federal law.

The primary issue with respect to the armed forces is whether the use of the active duty³⁹ military violated the *Posse Comitatus* Act, 18 U.S.C. §1385, which prohibits the use of the Army "as a *posse comitatus* or otherwise to execute the laws." The *Posse Comitatus* law arose out of post-Civil War concerns that the armed forces had become an instrumentality of federal law enforcement in the occupied southern states. The overriding purpose of the legislation was to preclude the military from direct participation in arrests, searches and seizures. While the law establishes the important principle of separation of civil and military actions, it has never been the

³⁷The phrase "armed forces of the United States" customarily does not include the National Guard unless ordered into federal service, which did not occur at Waco. However, the Office of Special Counsel chose to read "armed forces of the United States" to include "armed forces of a state of the United States" so as to give the American public complete disclosure of military activity at Waco.

³⁸The conclusion that the military support provided at Waco was legal is not a close call. The applicable laws unequivocally permit such military assistance. Much of the criticism of the military support provided at Waco has focused on the issue of whether the law <u>should</u> permit this type of military assistance. This is a question for Congress and not for the Office of Special Counsel.

³⁹The term "active duty" means full-time duty in the active military service of the United States. See 32 U.S.C. §101(12).

basis of a successful prosecution. The *Posse Comitatus* Act does not prohibit all military support to civilian law enforcement, but only support that directly involves the military in law enforcement functions. Supplementing the *Posse Comitatus* Act, the Military Assistance to Law Enforcement Act, 10 U.S.C. §§ 371-378, precludes direct participation by active duty forces in searches, seizures, and arrests, but permits indirect support to law enforcement operations such as loaning equipment, training in the use of the equipment, offering expert advice, and providing equipment maintenance. These laws do not apply to the National Guard unless it is federalized by being ordered to active duty by the President.

In arriving at its conclusions regarding the use of the armed forces at Waco, the Office of Special Counsel considered the legality of armed forces support in five principal areas:

(a) operations support, (b) equipment, (c) training, (d) expert advice, and (e) National Guard.

(a) Operations Support. In its investigation of the active duty military, the Office of Special Counsel focused on the level of participation by military personnel in law enforcement operations. In concluding that all active duty military support was legal, the Office of Special Counsel analyzed the support provided during three time periods: (1) preparation for the ATF operation of February 28, 1993, (2) the 51-day standoff, and (3) the activities of April 19, 1993.

1. <u>Pre-February 28, 1993</u>. Members from a detachment of the Rapid Support Unit ("RSU"), Operational Detachment "Alpha" 381 ("ODA 381"), which was comprised of ten U.S. Army Special Forces soldiers, provided assistance to ATF during its training at Ft. Hood, Texas, during February 1993. Specifically, ODA 381 reserved a facility at Ft. Hood that represented the complex, constructed a portable door entry and a reusable window for the facility, outlined part of the Davidian complex with engineering tape using photographs, facilitated the use of the ranges at

Ft. Hood, and served as human "silhouettes" of Davidians during ATF room-clearing exercises. This support is "indirect" military assistance that is within the bounds of applicable law and regulations.

In addition, the Office of Special Counsel has investigated the allegation that members of ODA 381 were present during the ATF's attempt to execute warrants at the Davidian complex. The Office of Special Counsel has concluded that no member of ODA 381 was present during the ATF's raid of the Branch Davidian complex. The evidence, including witness statements, a travel voucher, and a hotel receipt, indicates that four members of ODA 381 were late returning to McGregor Range at Ft. Bliss in El Paso, Texas, due to a flat tire and a severe thunderstorm and not because they had disobeyed orders and become participants in the ATF raid.

2. Support During the Standoff. Most of the active duty military support provided to the FBI during the 51-day standoff consisted of repair and maintenance of the equipment loaned to the FBI. This type of operations support is clearly legal.⁴⁰ Generally, FBI personnel brought equipment to rear positions around the complex for repair and maintenance, or in the case of the loaned military helicopters, the FBI brought the helicopters to Ft. Hood. However, on at least two occasions, military personnel deviated from this standard procedure. On one occasion, a tank driven by an FBI agent broke down within sight of the Davidian complex, and some of the tank's maintenance crew rode in a Bradley vehicle to its location to correct the problem. On the other occasion, a member of the Army Special Forces went to a forward position to help replace a battery in surveillance equipment the FBI had placed on a water tower approximately one mile

⁴⁰10 U.S.C. § 374(a).

east of the complex. These deviations from the standard procedure did not constitute a "direct role" in law enforcement operations and the actions were, therefore, within the bounds of the law.

Throughout the standoff and on April 19, 1993, members of the Army Special Forces were at Waco as observers and technicians. During the standoff, there were a total of ten Army Special Forces personnel—seven equipment technicians and three observers—present at Waco. Typically, there were three or four present at any one time, one or two of whom were observers. The main purpose of the observers was to allow the Army Special Forces to learn how the FBI conducted a barricaded hostage operation using Special Forces equipment. Despite allegations to the contrary, the Office of Special Counsel has concluded that these Army Special Forces personnel did not penetrate the Davidian complex, did not offer to kidnap Koresh, did not place a shaped charge in the complex, did not wear clothing immune to infrared or thermal imaging detection, did not fire any weapons into the complex (and were not even armed), did not run their own separate Tactical Operations Center ("TOC"), and did not engage in any other action that violated the *Posse Comitatus* Act or any other criminal or civil statute. The Army Special Forces observation and equipment maintenance activities were well within the bounds of the law.

3. April 19 Support. The only active involvement of the military in the FBI operations on April 19, 1993, was to provide medical support to injured Davidians and government personnel. Several former Army lawyers expressed to the Office of Special Counsel some reservation about the propriety of the medical support provided by the active duty armed forces on April 19, because, by treating Davidians who may have been involved in the fire, military doctors may have become involved in crime scene activity and the chain of custody of

evidence. Indeed, such reasoning may have been behind the decision to preclude Army Special Forces medics from being present during the ATF operation on February 28. Nevertheless, the Office of Special Counsel concludes that the humanitarian provision of medical support did not violate any law. To the contrary, such support is justifiable within the relevant law, military regulations and policy.

(b) Equipment Support. From the evening of February 28 until after the fire on April 19, law enforcement agencies solicited and received large amounts of military equipment from the armed forces, including the United States Army Special Operations Command and the United States Air Force. The equipment included, among other things, two tanks, a transport aircraft, helicopters, ammunition, surveillance "robots," classified television jamming equipment, classified thermal imagers, classified ground sensing systems, classified remote observation cameras, mine detectors, search lights, gas masks, night vision goggles, concertina wire, tents, cots, generators, and medical supplies. In the case of the two tanks, among other equipment, the military commanders required that the offensive capability of the equipment be disabled before providing it to the law enforcement agency. While the level of support was extensive, there is no legal restriction on the amount of equipment the active duty military may supply civilian law enforcement agencies, provided that the level of support does not adversely affect national security or military preparedness. Since providing equipment to the FBI at Waco did not adversely affect national security or military preparedness, it was proper under the law.⁴¹

⁴¹10 U.S.C. § 372(a). Moreover, the Davidians were heavily armed with machine guns and grenades. Only heavily armored equipment could have adequately protected the FBI agents present at Waco from the Davidians. The armed forces were the only organization that had such equipment.

(c) Training of Law Enforcement Personnel. The active duty military provided training to law enforcement agencies both prior to and during the standoff stages of the Waco incident. Most of the training occurred in three discrete areas: (1) training of ATF personnel by ODA 381, prior to February 28, 1993, (2) training of FBI personnel in the use of unclassified equipment such as tanks and other vehicles during the 51-day standoff, and (3) training of FBI personnel by Army Special Forces personnel in the use of classified surveillance equipment during the 51-day standoff.

The relevant statutes⁴² and Department of Defense directive⁴³ permit the active duty armed forces to train law enforcement personnel, but the directive precludes "large scale" or "elaborate" training.⁴⁴ In February 1993, ATF requested extensive training from the active duty military in several areas, including close quarters battle training. Due to the law, military regulations and policy, the active duty armed forces scaled back the training requested by ATF. ODA 381 refused to provide the close quarters battle training⁴⁵ requested by ATF because such training is highly complex and was beyond the capabilities of the RSU at that time. The armed forces properly limited the areas of training to range safety, communications, and medical evacuation. With respect to the training of FBI agents in the use of military vehicles and

⁴²10 U.S.C. § 373(1); P.L. 101-510, div. A, title X, § 1004(b)(5).

⁴³DoD Directive 5525.5, paragraph E4.1.4.

⁴⁴The Office of Special Counsel found no established standard for what qualifies as "large scale" or "elaborate" training.

⁴⁵Of the six detachments within the RSU, ODA 381 was specifically chosen to work with the ATF because none of its members were trained in close quarters battle.

classified surveillance equipment during the 51-day standoff, such training is explicitly permitted under the relevant laws and regulations and was, therefore, proper.

(d) Expert Advice. The active duty armed forces of the United States provided expert advice to other government entities involved with the events at Waco, and all such advice was in accordance with law. Government entities requested advice from members of the active duty military on four occasions. In December 1992 and January 1993, ATF sought and received advice from the Department of Defense liaison to ATF regarding what military support was available to assist ATF's operation. From February 3 to 27, 1993, ATF requested through Joint Task Force Six ("JTF-6") (a military organization responsible for coordinating counterdrug activity) that a detachment from the RSU provide advice concerning the planning and execution of the raid on the Davidian complex. From February 28 to March 1, 1993, the Governor of Texas requested and received advice from a general at Ft. Hood on what federal agencies to contact and how to respond to requests for Texas National Guard support. Finally, on April 13 and 14, the FBI and the Department of Justice requested and received advice from present and former members of the Army Special Forces on the effects of the tear gas that the FBI planned to insert into the complex.

The relevant statute⁴⁶ and Department of Defense directive state that the active duty military may provide "expert" advice to law enforcement agencies, but the directive precludes "regular or direct involvement of military personnel in activities that are fundamentally civilian law enforcement operations."⁴⁷ The relevant active duty military authorities were well

⁴⁶10 U.S.C. § 373 (2).

⁴⁷See DoD Directive 5525.5, paragraph E4.1.5.

aware of this legal standard. With respect to ODA 381's involvement with ATF prior to February 28, the appropriate military authorities prohibited ODA 381 from providing some of the advice requested by ATF, including evaluating ATF's plan of operations. The military legal authorities determined that critiquing ATF's operations plan could constitute direct participation in law enforcement activity. Specifically, the commander of JTF-6 ordered ODA 381 not to become directly involved in ATF operational planning, nor assume responsibility for the ATF plan. The commander did authorize ODA 381 to assist ATF in setting up its practice area and critiquing the safety aspects of ATF's rehearsal. There is some evidence that a member of ODA 381 provided limited advice⁴⁸ in an area of his expertise on one occasion, but the Office of Special Counsel has concluded that the advice was within the bounds of the law.

The advice given to the Governor of Texas on February 28, 1993, consisted of discussing ATF's request for the loan of Bradley vehicles and informing the Governor of the capabilities of the FBI's HRT. The General gave very limited advice in an area of his expertise, and this advice was, therefore, permissible under the law.

Finally, the present and former members of the Army Special Forces whom the FBI flew to Washington, D.C. on April 14, 1993, to advise Attorney General Reno on the proposed tear gassing plan, explicitly told FBI and Department of Justice officials that they could not "grade your paper," meaning that they could not endorse or critique the gassing plan. Rather, they discussed the effects of CS gas on people, whether the delivery of tear gas could start a fire, whether the HRT personnel were fatigued or in need of retraining, and they described how the

⁴⁸A weapons sergeant for ODA 381 stated that he provided ATF general advice within his expertise in mounting and dismounting vehicles in a tactical manner, but he did not give specific advice to the ATF in mounting and dismounting the cattle trailers used in the February 28 raid.

military would conduct the operation. They emphasized the differences between military and civilian law enforcement operations. This advice was within the areas of their expertise and did not constitute direct participation in law enforcement activity.

(e) National Guard Support. The National Guard, in its state status, 49 also provided extensive support to ATF and the FBI at Waco. Prior to the February 28 operation, the Texas National Guard flew five reconnaissance flights over the Davidian complex. In addition, the Alabama National Guard made one surveillance flight in support of the Texas National Guard's counterdrug program. ATF sought and received the support of three Texas National Guard helicopters, flown by Guard personnel, to act as a diversion during the February 28 operation. These helicopters were hit by Davidian gunfire early in the ATF operation. Throughout March and April, Texas National Guard personnel were present at Waco and served primarily in maintenance, liaison, and support positions. On April 19, members of the Texas National Guard were present at Waco in their capacity as maintenance and support technicians, but none became directly involved in the law enforcement operation. Finally, the Texas National Guard provided substantial military equipment to the FBI beginning on the evening of February 28. Specifically, the Guard provided, among other equipment, ten Bradley vehicles, five Combat Engineering Vehicles ("CEV's"), one M88 tank retrieval vehicle, 12 M1009 vehicles, two heavy trucks, and various military supplies.

⁴⁹The National Guard provided personnel support under the counterdrug provisions of 32 U.S.C. §112. Most of the equipment loaned by the Texas National Guard was loaned in accordance with the requirements of National Guard Regulation ("NGR") 500-1, Military Support to Civil Authorities.

None of this support violated the *Posse Comitatus* Act because that Act does not apply to the National Guard in its state status. The Office of Special Counsel also considered, however, whether this support violated any other laws or the applicable National Guard regulations ("NGR's").⁵⁰ The Office of Special Counsel has concluded that the Texas National Guard's decision to accede to ATF's request by flying three National Guard helicopters near the complex on February 28, 1993, may have resulted in an inadvertent violation of guidance in NGR 500-2 which states that "pilots in command will not fly into or land in areas where the aircraft is likely to be fired upon"⁵¹ and commanders "will also ensure that Guard members are not knowingly sent or directed to enter into a hostile environment where there is a probability of encountering small arms fire or life threatening situations."⁵² Although the pilots indicated that they did not expect to be fired upon, the pilots knew that the Davidians were a dangerous group, and they did in fact take heavy fire from the Davidians during the ATF operations. Except for this possible inadvertent violation of guidance in NGR 500-2, the Office of Special Counsel has concluded the Guard's support was entirely in accordance with law and regulation.

The Office of Special Counsel has concluded that the allegation that National Guard helicopter crews fired at the Davidians on February 28 is without merit. Interviews with each of the crew members indicate that the Davidians fired at the helicopters, but that the

⁵⁰The National Guard relied upon both NGR 500-1 and NGR 500-2, National Guard Counterdrug Support to Law Enforcement Agencies to provide the support it did to the law enforcement agencies. Moreover, two versions of NGR 500-2 were used with the latter taking effect March 1, 1993.

⁵¹See NGR 500-2 dated October 1, 1992 at paragraph B-4 in Appendix B.

⁵²See NGR 500-2 dated October 1, 1992 at paragraph B-5 in Appendix B.

helicopter crews did not return fire. Video taken on board one of the helicopters confirmed that the crews immediately terminated the mission and landed their aircraft.

(f) Procedural and Administrative Issues. The Army conditions the loan of equipment on the execution of a loan agreement prior to delivery of the equipment. With respect to the equipment provided by the Army at Ft. Hood to the FBI after the February 28 ATF operation, the Army did not execute the lease agreement until June 30, 1993. The Office of Special Counsel considers this delay to be a procedural matter requiring no action on its part.

In addition, there has been extensive prior investigation into the issue of whether ATF fabricated information concerning drug use and production by the Davidians in order to obtain military support of the counterdrug resources of the active duty armed forces and the National Guard in preparation for the original raid on the complex, with sharply conflicting conclusions.⁵³ The issue is relevant to the charter of the Office of Special Counsel if the lack of a drug nexus would have precluded otherwise permissible activity of the armed forces of the United States.⁵⁴ It is important to note that the vast majority of military support provided at Waco was

⁵³There is no legal standard for how strong the drug nexus needs to be in order to obtain military support. Clearly there was some investigation by ATF into possible drug activity at the complex, and ATF sought some assistance from the United States Drug Enforcement Administration ("DEA"). Moreover, there is no requirement that the military independently investigate the accuracy of the drug nexus alleged by a law enforcement agency soliciting military support.

⁵⁴The issue of a drug nexus also goes to the question of whether the active duty military and National Guard had to be reimbursed for providing support to law enforcement agencies. If there is a drug nexus, then support provided by the armed forces premised on that drug nexus does not have to be reimbursed. See the National Defense Authorization Act of 1991, P.L. 101-510, div. A. Title 10 § 1004, November 5, 1990, 104 Stat. 1485 and 32 U.S.C. §112. In the case of Waco, the vast majority of costs were reimbursed, and the issue of reimbursement was accurately addressed in the Report of the General Accounting Office of August 1999. Therefore, the Office of Special Counsel did not re-investigate this matter.

not premised on any alleged drug nexus. Only the limited training provided to the ATF by ODA 381 before February 28 and some of the National Guard support were based on the drug allegations. None of the support provided by the active duty military to the FBI from February 28 through April 19, 1993, was in any way dependent on drug allegations. Thus, the drug nexus is a very minor issue with respect to this investigation.

Although the Office of Special Counsel did not extensively investigate the basis for ATF's assertion that there was a drug nexus, there is some evidence prior to February 28, 1993, connecting "drug activity" with the complex which could form the basis of a drug nexus (although ultimately federal agents found no evidence of illegal drugs at the complex). Even if there had been no such nexus, the Office of Special Counsel has concluded that law enforcement agencies could have obtained the same level of support from the armed forces. While ATF would not have been permitted to make use of the counterdrug administrative resources of JTF-6 had there not been a drug nexus, the active duty military could have provided virtually the same support through other means even without a drug nexus. Similarly, the National Guard could have supported law enforcement in the manner it did without a drug nexus, although obtaining such support may have been somewhat difficult under the relevant law and regulations. Regardless of the level of drug

⁵⁵The apparent drug nexus included ATF's claim of four prior drug arrests and one drug conviction of Davidians, a "hot spot" detected in the complex during the Guard's surveillance flights which purportedly was an indicator of an active methamphetamine lab, and the alleged presence of a methamphetamine lab at the complex in the late 1980's. However, others have noted that there was no evidence of active use of drugs at the complex in 1993 and that Koresh had allegedly removed the methamphetamine lab when he took control of the Davidian group.

⁵⁶If there were no drug nexus, all of the National Guard's support would have been provided under NGR 500-1. Obtaining the same support may have been difficult (but not illegal) because some of the support such as surveillance flights is not directly addressed in NGR 500-1, as it is in NGR 500-2.

nexus present, therefore, the Office of Special Counsel has concluded that the active duty military and National Guard lawfully provided their support. In sum, the armed forces conducted themselves properly and commendably at Waco.

5. Did any employee of the United States make or allow others to make false or misleading statements, or withhold evidence or information from any individual or entity entitled to receive it, or destroy, alter, or suppress evidence or information relative to the events occurring at the Branch Davidian complex on April 19, 1993?

Attorney General Reno gave the Special Counsel a broad mandate to investigate whether employees of the United States covered up material information concerning the government's actions at Waco on April 19, 1993. Public concerns about a potential cover-up stemmed principally from several revelations in August and September of 1999: (1) that the FBI had fired pyrotechnic tear gas rounds on April 19, 1993, contrary to the repeated public denials of the FBI and Department of Justice for over six years; (2) that a previously undisclosed FLIR video recorded during the early morning of April 19, 1993, contained confirmation that the FBI fired such pyrotechnic tear gas rounds; and (3) that the 49th page of a key FBI lab report, which indicated that a shell from one of the pyrotechnic tear gas rounds was found near the Branch Davidian complex after April 19, 1993, was omitted from the document production made to Congress prior to the 1995 hearings.⁵⁷ The Office of Special Counsel, therefore, focused its cover-up investigation on determining whether employees of the FBI or Department of Justice

⁵⁷There was also substantial public concern over the revelation that military Special Forces personnel had been present at Waco and were alleged to have participated in the operation. The Office of Special Counsel has definitively laid to rest the allegations concerning the activities of the Army Special Forces, as previously discussed in Section 4 above.

deliberately concealed the FBI's use of pyrotechnic tear gas rounds from Congress, the courts, counsel for the Davidians, and the American public. The Office of Special Counsel devotes much of its "cover up" analysis below to answering this question. In short, the Office of Special Counsel has concluded that numerous individuals knew that the FBI had fired pyrotechnic tear gas rounds on April 19, 1993. Several of these individuals should have, but did not, disclose this fact to the Attorney General, Congress, the courts, and counsel for the Davidians.

Consistent with its mandate, the Office of Special Counsel also pursued numerous other cover-up allegations and leads ranging from inconsistencies among witnesses' accounts, to claims of broad government-wide conspiracies to cover up activities that occurred at Waco other than the firing of the pyrotechnic tear gas rounds. None of these allegations resulted in any credible evidence of misconduct by any government employee.

Three of these issues, however, have generated significant public concern, and the Special Counsel therefore feels it is appropriate to put these concerns to rest. These issues are: (1) whether the FBI deceived Attorney General Reno about the conditions in the complex and the status of negotiations prior to her approval of the tear gas plan; (2) whether any FBI employee intentionally removed audio from the FLIR tape recorded by the FBI Nightstalker aircraft from 10:42 a.m. until 12:26 p.m. on April 19; and (3) whether the FBI commanders at Waco lied to Congress in 1995 and to the Office of Special Counsel when they stated that they ordered a CEV to penetrate the complex on April 19 in order to create escape routes for the Davidians and deliver tear gas. As described below, the Special Counsel has concluded that: (1) the FBI did not deceive

Attorney General Reno prior to her approval of the tear gas plan; (2) the FBI did not remove the sound or otherwise alter the FLIR tape covering the period 10:42 a.m. to 12:26 p.m.; and (3) the FBI commanders were truthful in their testimony about the purpose for breaching the complex.

(a) Did government officials intentionally conceal the FBI's use of pyrotechnic tear gas rounds from Congress, the courts, counsel for the Davidians, and others from April 1993 until August 1999? As detailed earlier, the FBI fired three pyrotechnic tear gas rounds at the concrete construction pit outside the main structure of the complex shortly after 8:00 a.m. on April 19, 1993. The firing of these rounds neither started nor contributed to the spread of the fire that consumed the complex four hours later. However, until August of 1999, FBI and Department of Justice officials repeatedly denied that the FBI had used *any* such device during the tear gassing operation. These statements were false, and the failure to acknowledge the use of pyrotechnic tear gas rounds for more than six years has greatly undermined public confidence in government.

To provide some context for its specific conclusions, the Office of Special Counsel offers the following overview, which (i) defines the issue with specificity, and (ii) summarizes the misleading statements and missing evidence that have been the subject of the investigation.

1. <u>Terminology Issues</u>. Whether or not there was a cover-up is in many respects dependent upon nuances in terminology. The first issue relates to the difference between "pyrotechnic" and "non-pyrotechnic" tear gas rounds. In March and early April 1993, as the FBI developed its tear gassing plan, several people– from the FBI, the Department of Justice, and the military– raised the concern that the tear gassing operation could cause a fire. Throughout consideration of the plan, the FBI gave its assurances to anyone who asked that the tear gas would

be delivered through non-pyrotechnic means, meaning that the tear gas would not be spread with a charge that burns. However, the plan approved by Attorney General Reno did not use the words "pyrotechnic" or "non-pyrotechnic," stating only that the FBI was to deliver tear gas to the complex through booms on CEV's or, if the Davidians fired upon the FBI, through "ferret rounds" fired from M-79 grenade launchers. Canisters attached to booms on CEV's spray CS gas without any sort of pyrotechnic charge to effectuate the delivery of the gas. A Ferret projectile, a plastic bulb with fins, breaks open on impact and disperses the CS gas in a liquid form without using a pyrotechnic charge. While the plan authorized the use of two forms of non-pyrotechnic tear gas, it did not expressly preclude the use of pyrotechnic means of delivery. There is no dispute, however, that Attorney General Reno expressly prohibited the use of pyrotechnics during her discussions of the plan with the FBI.

Further complicating the issue is that the word "pyrotechnic" is often, but mistakenly, used synonymously with the word "incendiary." The purpose of an incendiary device is to cause a fire. Technically, therefore, a pyrotechnic tear gas round is not "incendiary." Pyrotechnic tear gas rounds can cause a fire under certain circumstances, but they are not designed to do so and are non-incendiary. Statements that the FBI did not fire "incendiary" devices at Waco on April 19 are technically true, but could be misleading.

Further still, HRT commander Rogers, who authorized the use of the pyrotechnic tear gas rounds, asserted that the prohibition against pyrotechnics applied only to the introduction of tear gas at the living quarters of the Davidians, and did not apply to the concrete construction pit 75 feet from the living area of the complex. Attorney General Reno believes her exact words prohibited pyrotechnics "at the compound," which in her mind included the concrete construction

pit. However, she has fully acknowledged that there was no discussion of what the "compound" was, and that others might not have understood the concrete construction pit to be part of the "compound." Attorney General Reno had the impression that the FBI would not use pyrotechnic devices during any phase of the operation, but Rogers did not share that belief, so there was no meeting of the minds.

This situation creates semantic difficulties in determining whether the FBI or Department of Justice covered up the FBI's use of pyrotechnic devices. Some of the statements that led the public to believe that the FBI had not used any pyrotechnic devices on April 19 suggest only that no pyrotechnic devices were fired at the "compound" and arguably do not encompass the concrete construction pit. Another misleading statement, contained in a Department of Justice report on Waco, states that the FBI used only "non-incendiary" devices at Waco, which is, again, technically true because pyrotechnic tear gas rounds are not incendiary, although some government personnel used the terms "pyrotechnic" and "incendiary" interchangeably.

The issue is even further complicated by the various alternative names given to pyrotechnic tear gas rounds. In addition to the official designation of XM651E1 and abbreviated designation of M651, pyrotechnic tear gas rounds have been commonly referred to as "military rounds." At least one FBI agent allegedly referred to them as "cupcake rounds." Some government employees have used the term "bubblehead" during the past seven years to describe the appearance of pyrotechnic tear gas projectiles. Much of the documentary and testimonial evidence from 1993 and 1994 confirming that the FBI fired three pyrotechnic rounds at Waco on April 19 makes no mention of the word "pyrotechnic," but rather refers to M651 casings, military

rounds, cupcake rounds, or bubbleheads. As described below, some individuals with access to this information, who nonetheless failed to inform Congress, the public, or the courts that the FBI used the pyrotechnic gas rounds, have told the Office of Special Counsel that they did not understand that military tear gas rounds, bubbleheads, or cupcake rounds were pyrotechnic.

2. The Misleading Statements and Missing Evidence. The following trail of public statements led the American people to believe that the FBI had not used pyrotechnic tear gas rounds on April 19, 1993. Immediately following the fire, FBI Special Agent-in-Charge and spokesperson Robert Ricks stated at a press conference that the FBI had not used any pyrotechnic devices during the entire tear gassing operation. In a prepared statement, Ricks stated, "the gas used was non-pyrotechnic; CS gas which does not cause a spark or flame. Also the delivery system utilized is non-pyrotechnic." In this same statement, Ricks later stated, "there was no gas being inserted into the building at the time of the fire. No pyrotechnics were used at any time." A few days later, Attorney General Reno told Congress that in discussions prior to her approval of the plan she "asked for and received assurances that the gas and its means of use were not pyrotechnic." Director Sessions told the same congressional committee that a critical factor in the FBI's choice of CS gas was that it "can be used without pyrotechnics." The "Report to the Deputy Attorney General on the Events at Waco, Texas February 28 to April 19, 1993" (the "Scruggs Report") issued by the Department of Justice on October 8, 1993, stated that "a nationally recognized team of arson experts has also concluded that ... the gas delivery systems that the FBI used were completely nonincendiary."

During the preparation for the criminal prosecution of the Davidians in 1994, although HRT witnesses had told prosecutors that the FBI had fired "military rounds," "cupcake

rounds" and "bubbleheads," (and the prosecutors' and paralegal's notes include the term "incendiary" to describe the rounds), prosecutors formally advised the defense counsel that there was "no evidence government agents fired gunshots on April 19, 1993 other than ferret tear gas rounds." (Emphasis supplied.) Under the case of *Brady v. Maryland*, 373 U.S. 83 (1963), prosecutors are required to provide the defense with exculpatory evidence, and, even though the question of who started the fire was an issue in the case, the prosecutors failed to disclose to the defense the FBI's use of the pyrotechnic tear gas rounds.

During the joint hearings in 1995 by the House Committee on Government Reform and Oversight and the Committee on the Judiciary, the Committees issued a request for documents to the Department of Justice, specifically asking for "a listing of all pyrotechnic and incendiary devices" used at the Davidian complex. The Department of Justice provided no such list in its response to Congress. Rather, Department of Justice employee Richard Scruggs has acknowledged that during several informal briefings he told members of the Committees that the FBI used no pyrotechnic devices at Waco on April 19, 1993. Additionally, a member of the criminal trial prosecution team, Ray Jahn, submitted a written statement to the Committees stating that the FBI fired nothing on April 19 "other than the non-lethal ferret rounds which carried the CS gas." As discussed in more detail below, he has admitted that this statement is false but claims that he was merely "negligent" in not disclosing that rounds other than Ferret rounds had been used.

Several internal Department of Justice and FBI documents demonstrate how some of these incorrect statements to Congress originated. In preparation for its response to the congressional request for documents, Scruggs received a memo in June of 1995 from FBI

headquarters staff specifically stating that "there were no incendiary or pyrotechnic devices used against the Branch Davidians on 4/19/93." The Department of Justice later assembled a briefing book for Attorney General Reno which included a section on the flammability of CS gas. It concluded: "[P]yrotechnic rounds are not used by the FBI."

During the pre-trial phase of the civil lawsuit filed against the United States, counsel for the Davidians and their families filed the affidavit of an expert who received information from a Davidian attorney, Kirk Lyons, that a round referred to as a "bubblehead" was fired at the complex on April 19. The expert noted that "military pyrotechnic munitions" may have been used by the FBI against the Davidians. Later, after more evidence of the use of such a round was advanced by the Davidians, the civil trial team filed a pleading incorrectly implying that the Davidians may have fired a pyrotechnic tear gas round, not the FBI.

Adding to the concerns raised by this series of misleading statements is that, to this day, no one can locate any of the three expended pyrotechnic tear gas projectiles, and no one has located two of the three shells. An FBI explosives expert has told the Office of Special Counsel that he saw two military tear gas projectiles on April 20, 1993, lying next to the concrete construction pit, and on April 30 a photographer photographed the third projectile which had been marked for evidence collection. One of the Texas Rangers who was on the scene recalls collecting one expended shell, and discussing the shell with an FBI agent, who said he would have it examined, and later confirmed that it was a military tear gas shell. This shell is the only one in evidence. In addition, an FBI lab report detailing some of the evidence contains a reference only to this one casing.

Equally disconcerting is the failure of the FBI to release, until September 1999, the early morning FLIR tape on which HRT commander Rogers is heard authorizing the firing of the military tear gas rounds. On a subsequent tape, approximately 18 minutes later, the HRT Charlie Team reports that the military rounds had bounced off the concrete construction pit. The FBI emphatically denied for years preceding their release that any such early morning FLIR tapes existed, raising concerns that these FLIR tapes remained undisclosed precisely because they contained independent confirmation that the FBI fired pyrotechnic tear gas rounds on April 19.

Finally, in September of 1999, the Department of Justice acknowledged that, in 1995, it produced to Congress an incomplete, 48-page version of the 49-page FBI evidentiary laboratory report. The missing 49th page of the report discloses that a 40 millimeter military tear gas shell was recovered at the Branch Davidian complex.

Considering the large number of misleading statements and omissions, as well as the missing physical evidence, it would appear that there was a cover-up. However, there are countervailing considerations. First, all entities which received misleading information—Congress, the courts and counsel for the Davidians—concurrently received other information indicating that the FBI had in fact fired pyrotechnic rounds at Waco. For example, despite the misleading testimony cited above, Congress acknowledged that it received in 1995 several documents that referred to the use of "military rounds" by the FBI at Waco. Similarly, while the prosecutors did not make affirmative disclosure that the FBI used pyrotechnic tear gas rounds to the Davidians, on December 15, 1993, Assistant United States Attorney LeRoy Jahn did provide defense counsel for the Davidians with the FBI laboratory report that contains the reference to the military tear gas shell and the photograph of the projectile. Further still, some of the lawyers for

the Davidians in the civil suit received the FBI lab report, the photograph, and notes from the preparation for the earlier criminal trial in which the Department of Justice trial team made reference to "military rounds" and "bubbleheads."

3. <u>Conclusions regarding a possible cover-up</u>. The Office of Special Counsel has resolved the issues concerning the cover-up investigation as follows.⁵⁸

A. Statements of the Attorney General. The Office of Special Counsel has concluded that Attorney General Reno did not knowingly cover up the use of pyrotechnic tear gas rounds by the FBI. The evidence is overwhelming that, prior to the execution of the gassing plan, she sought and received assurances from the FBI that it would not use pyrotechnic tear gas rounds. The evidence is equally conclusive that the briefing materials and other information she received after the fact stated that the FBI had not used pyrotechnic tear gas rounds at Waco. Any misleading statement that she made was inadvertent and occurred after diligent efforts on her part to learn the truth. The Office of Special Counsel has found Attorney General Reno to be without direct fault for any false statements that she may have made.

B. FBI Statements in 1993. The Office of Special Counsel has also concluded that FBI Director Sessions did not knowingly mislead Congress in 1993 regarding the FBI's use of pyrotechnics at Waco. Director Sessions' statement that CS gas was chosen because it could be used without pyrotechnics was true. He simply did not know that three pyrotechnic military tear gas rounds had also been used on the morning of April 19. Similarly, when Ricks gave his press briefing immediately after the fire, he did not know that any pyrotechnic tear gas rounds had been

⁵⁸The Office of Special Counsel provided those individuals whom this Report criticizes an opportunity to respond to the conclusions contained herein. Those responses are contained in Exhibit 2.

used. The FBI's plan clearly called only for the use of Ferret tear gas rounds which are non-pyrotechnic, and no one told Ricks that the HRT had used pyrotechnic tear gas rounds that morning.

C. The Scruggs Report and Investigation. As stated earlier, in 1993, a team of Department of Justice lawyers and FBI investigators, led by Richard Scruggs, issued a report on the events at Waco. Although they did not investigate the issue of pyrotechnics, the Scruggs Report indicated that the tear gas rounds used by the FBI at Waco was "non-incendiary." Members of the Scruggs team went into the project with the assumption that the FBI had done nothing wrong. Former Deputy Attorney General Philip Heymann, who oversaw the entire project, agreed with this characterization of the Scruggs investigation. The Scruggs team did not even ask witnesses about the use of pyrotechnic rounds. During interviews of the HRT Charlie Team, the Scruggs investigators failed to ask about the different types of munitions fired on April 19. Even so, one witness told the investigators that he had heard radio transmissions about the use of a "military round" on April 19. The Scruggs team attributed no significance to this term, and did not pursue the matter. The Scruggs team was also aware of the video Waco: The Big Lie, produced by Linda Thompson, which contains news footage of "smoke" rising from the concrete construction pit. The film alleges that this "smoke" is evidence that the FBI started the fire. Even though the Scruggs Report discusses the cause of the fire, the Scruggs team never investigated the origin of this "smoke," which was actually tear gas emanating from a pyrotechnic military tear gas round. Lastly, Scruggs' FBI investigators had access to the FBI's photos, including the photo depicting a cloud of "smoke" rising from the area of the concrete construction pit and the photo of the military tear gas round in the field.

The failure of the Scruggs team to discover and report that the FBI used pyrotechnic tear gas rounds was the result of initiating the investigation with the assumption that the FBI had done nothing wrong, was inconsistent with the responsibility to conduct a thorough and complete investigation, and was clearly negligent.

D. The FBI Hostage Rescue Team. In November 1993, the team prosecuting the Davidians interviewed members of the HRT at Quantico, Virginia. Those who knew of the use of the military tear gas rounds, including HRT commander Rogers, admitted openly to the criminal prosecution team that the FBI had fired the military tear gas rounds at the concrete construction pit on April 19. In addition, HRT Special Agent Robert Hickey acknowledged the use of the military tear gas rounds and their capacity to start a fire in a memorandum to an FBI lawyer in February 1996. HRT members candidly admitted to the Office of Special Counsel that they had used these rounds. There was clearly no attempt on their part to conceal the use of military tear gas rounds.

HRT commander Rogers did, however, sit silently behind Attorney General Reno when she testified to Congress in April 1993 that she had sought and received assurances that the gas and its means of delivery would be non-pyrotechnic. Rogers claims that he was not paying attention and did not even hear her when she made this statement, and Attorney General Reno notes that her statement was technically true because she sought and received the assurances before the operation. Similarly, Rogers attended the 1993 testimony of FBI Director Sessions, and did not correct misimpressions left by Sessions' statement that the FBI had chosen CS gas because it could be delivered without pyrotechnics. Rogers' failure to correct the misleading implications of the testimony of Attorney General Reno and Director Sessions was a significant omission that contributed to the public perception of a cover-up and that permitted a false

impression to persist for several years. Rogers attended the congressional hearings precisely to ensure that Congress was provided with accurate information. Instead, in the terms of the Attorney General's Order to the Special Counsel, Rogers "allowed others to make . . . misleading statements." Nevertheless, the Office of Special Counsel has determined that Rogers' conduct did not constitute a prosecutable offense because: (1) the statements of Attorney General Reno and of Director Sessions were technically true; (2) Rogers did not have a *legal* obligation to ensure the accuracy of another person's testimony; (3) and it is impossible to prove that Rogers actually heard and comprehended the Attorney General's or FBI Director's statements. In any event, the statute of limitations relating to the statement before Congress expired in 1998.

E. Attorneys Preparing for the 1995 Congressional Hearings. Attorneys from the Department of Justice who produced documents to the United States House of Representatives Committee on Government Reform and Oversight and the Committee on the Judiciary in advance of the 1995 hearings have come under public scrutiny for producing the FBI laboratory report containing the reference to the military tear gas shell without the 49th page, which contains the relevant reference. In fact, however, while one copy of the report did not contain the 49th page, the Committees were provided with at least two copies of the lab report in 1995 which did contain the 49th page. The Office of Special Counsel easily located these complete copies of the lab report at the Committees' offices when it reviewed the Committees' copy of the 1995 Department of Justice document production. The Department of Justice document production to the Committees also included several other documents that referred to the use of the military tear gas rounds, including the criminal prosecution team's witness summary chart and interview notes. The

Special Counsel has concluded that the missing page on one copy of the lab report provided to the Committees is attributable to an innocent photocopying error.

The Office of Special Counsel has also investigated the origins of certain internal Department of Justice and FBI documents generated in connection with the 1995 hearings. The Committees conducting the hearings were investigating the issue of pyrotechnics, as indicated by their June 8, 1995, request for documents which sought, among other things:

[a]ll records of or concerning pyrotechnic devices and incendiary weaponry, including a listing of all pyrotechnic and incendiary devices and corresponding technical data and manufacturer used on April 19, 1993, against the Residence of Koresh and the Branch Davidians . . . [a]ll records of or concerning the names of FBI employees who launched any such pyrotechnic devices . . . [and all] records of or concerning the names and command structure for the decision to use any pyrotechnic or incendiary devices

A team of attorneys at the Department of Justice, once again led by Richard Scruggs, Steven Zipperstein, and Robert Lyon, spent several months preparing for the hearings. As part of their work, these attorneys prepared briefing materials for Attorney General Reno on issues that they expected Congress to raise during the hearings. Several of those documents incorrectly state that pyrotechnic devices were not used at Waco. Also, several documents sent from the FBI to the Department of Justice in response to questions raised during preparations for the hearings wrongly state that the FBI used no pyrotechnic devices at Waco. The Office of Special Counsel has not found any evidence that these misstatements were deliberate.⁵⁹

⁵⁹The Office of Special Counsel also investigated a statement that Ray Jahn, the head of the criminal prosecution team that prosecuted the Branch Davidians, submitted to Congress in 1995. This statement will be discussed in the analysis of the criminal prosecution team's activities below.

In particular, the Office of Special Counsel investigated the origins of the following incorrect statements in internal Department of Justice and FBI documents:

- The Attorney General Briefing Book, August 1995, prepared by Department of Justice attorneys for Attorney General Reno, includes a page entitled "Issue: Flammability of CS Gas." This page states that an independent arson team found that the tear gas and delivery system did not "contribute to the ignition or spread of the fire" and concludes with the statement that "In summaary [sic], pyrotechnic rounds are not used by the FBI."
- Waco Fact Sheet No. 39 prepared by Department of Justice attorneys states that "Monty Jett, the firearm expert at Quantico who suggested the CS gas and the ferret round delivery system, stated that they were made for indoor use and were non-flammable."
- Waco Fact Sheet No. 45 prepared by Department of Justice attorneys, states that CS gas
 "is the most tested chemical agent in the world, is approved by the surgeon general and is non-pyrotechnic in the method in which it was utilized."
- A facsimile from Linda Bateman, in the FBI's Office of Public and Congressional Affairs, to Richard Scruggs in a response to Congress' request for documents regarding pyrotechnic or incendiary devices states that "[T]here were no incendiary or pyrotechnic devices used against the Branch Davidians on 4/19/93." A facsimile from Tony Betz, Unit Chief of the FBI's Domestic Terrorism Unit, to Department of Justice attorney Helene Goldberg states that "CS gas is the safest and most extensively researched riot control agent known. . . The FBI has specifically chosen methods of delivery and dispersal of CS that do not utilize pyrotechnic or incendiary components."

During the congressional 1995 hearings, Attorney General Reno was not asked about pyrotechnic devices. Both Scruggs and John Collingwood, an FBI Assistant Director, Office of Public Affairs, told the Office of Special Counsel, however, that they had informed Congressional staffers that the FBI had used no pyrotechnic devices on April 19, 1993. Several Congressional staffers confirmed that they were told by FBI and Department of Justice representatives that no pyrotechnics were used. In addition, Congress received the erroneous Waco Fact Sheets after the hearings.

The Office of Special Counsel has identified the sources of all of these incorrect statements, and it has concluded that all of these individuals believed that the FBI did not use pyrotechnic devices on April 19, 1993. While Department of Justice attorneys preparing for the hearings did investigate the use of pyrotechnic devices on April 19, 1993, on several occasions, they were told, ostensibly by knowledgeable FBI employees, that the FBI did not use pyrotechnic devices to deliver the tear gas on April 19. Individuals who were asked whether pyrotechnic devices were used may have been negligent in failing to thoroughly research the issues, but there is no indication anyone intentionally provided false information.

Specifically, Linda Bateman of the FBI's Office of Public and Congressional Affairs told Scruggs that the FBI used no pyrotechnic or incendiary devices at Waco on April 19, 1993. Bateman obtained this information from James Atherton, an HRT explosives expert who had been at Waco on April 19. Atherton was not, however, part of the Charlie Team which had actually fired the pyrotechnic rounds. He told the Office of Special Counsel that he was the source of the incorrect information and that he did not know that the HRT had fired any

pyrotechnic tear gas rounds and did not make inquiries to find out otherwise. This Office found Atherton to be credible in all respects and has no reason to doubt his statement.

Helene Goldberg and other Department of Justice attorneys met with Tony Betz, the Unit Chief of the FBI's Domestic Terrorism Unit, in preparation for the 1995 hearings. Betz was involved with the situation at Waco from the beginning of the standoff through the development and implementation of the tear gas plan, but was not at Waco on April 19, 1993. Betz told Helene Goldberg in a fax that the FBI had specifically chosen "methods of delivery and dispersal of CS that do not utilize pyrotechnic or incendiary components." Betz did not interview any HRT members before drafting this statement. Rather, Betz believed that the statement was true, based both on his own involvement with the Waco matter and the discussions he had with Monty Jett, the FBI munitions expert who set up the tear gas delivery systems for use on the CEV's at Waco. Jett provided extensive information to Tony Betz and to FBI attorneys who were working on the 1995 hearings. Jett was involved in ordering equipment, including the Ferret rounds, used in the tear gas operation, and he believed that the FBI had used only equipment that he had ordered. Jett did not discuss the use of pyrotechnics with any members of the HRT. Accordingly, the possibility that the FBI had used pyrotechnic tear gas rounds never crossed his mind and he told anyone who asked that the FBI had used no pyrotechnic tear gas rounds. The Office of Special Counsel found Jett to be credible on this point.

The Office of Special Counsel has found no evidence that anyone involved in preparations for the 1995 hearings ever asked any member of the Charlie Team or HRT commander Rogers about pyrotechnic devices. It has found no evidence that anyone involved in the preparations ever learned that the FBI had fired pyrotechnic devices. In short, there is no

evidence that anyone deliberately provided false or misleading information in preparation for the 1995 Congressional hearings.

The Department of Justice attorneys working on the 1995 hearings made a good faith effort to confirm their belief (based on the Scruggs Report) that pyrotechnic devices had not been used on April 19, 1993. Indeed, while the Office of Special Counsel is critical of the investigation conducted by the Scruggs team in 1993, it would be unfair to criticize the Department of Justice lawyers for their efforts in 1995. In spite of Scruggs' own belief that the FBI had used no pyrotechnic devices, he inquired further in 1995 and the FBI told him plainly that the FBI had not used pyrotechnic devices on April 19.

In concluding that Congress was not intentionally misled, the Office of Special Counsel notes that the Department of Justice did produce to Congress several documents indicating that the FBI had fired military rounds on April 19. In addition to the FBI laboratory report, the Department of Justice gave Congress copies of a paralegal's notes of the criminal prosecution team's interview of HRT's Charlie team (which include a misspelling of the word "incendiary" to describe the military round)⁶⁰ and of the notes of the interview of HRT commander Rogers, as well as the trial team's witness outline which referred to military rounds. The production of these documents is further evidence that there was no deliberate effort to conceal this information from Congress.

It is not surprising, however, that the Congressional investigators did not find these references to military rounds or connect them to the use of pyrotechnic devices. As Scruggs and

 $^{^{60}\}mbox{The paralegal's handwriting}$ and spelling would make it difficult for almost anyone to decipher the word.

Collingwood made clear, Department of Justice and FBI representatives assured them on several occasions that the FBI had not used pyrotechnic devices at Waco. The FBI submitted written Fact Sheets which contained the same assertions. Given these assurances, it is unreasonable to suggest that Congressional staffers should have found and appreciated the significance of a few references to "military rounds" buried in thousands of pages of documents produced by the Department of Justice before the hearings.

F. <u>Criminal Prosecution Team.</u> Several weeks after the standoff began, the Department of Justice assigned Assistant United States Attorney Ray Jahn to serve as the lead prosecutor in the government's case against the surviving Davidians. His wife, LeRoy Jahn, also an experienced federal prosecutor, served as his principal assistant. The other members of the team who prosecuted the Davidians were also experienced federal prosecutors: Assistant United States Attorneys William "Bill" Johnston and John Phinizy, and Department of Justice attorney John Lancaster. The team was assisted by paralegal Reneau Longoria. The Office of Special Counsel has concluded that prosecution team members knew in November 1993 both that the FBI had fired "military" rounds at Waco and that these rounds were pyrotechnic; however, the team did not disclose this information to the defense attorneys for the Davidians or to their superiors within the Department of Justice.

The Office of Special Counsel has devoted considerable time and resources to investigating whether any members of the criminal prosecution team engaged in a cover-up of the FBI's use of these pyrotechnic military rounds at Waco. While other members of the prosecution team bear some responsibility for failing to disclose this information, the Office of Special Counsel has concluded that members of the team, Ray and LeRoy Jahn, and

went to great lengths to conceal their knowledge of the military rounds, obstructing the investigation and severely hampering the Office's ability to uncover the truth about what happened in 1993.

1. Ray and LeRoy Jahn

The Office of Special Counsel has investigated exhaustively the conduct of the Jahns before, during and after the criminal trial of the Davidians to determine whether they engaged in a cover up of the FBI's use of three pyrotechnic tear gas rounds at Waco on April 19, 1993. In particular, the Office of Special Counsel focused on three critical issues: (1) whether at any time prior to August 1999 the Jahns knew that the FBI had fired the pyrotechnic tear gas rounds; (2) if they knew about the pyrotechnic rounds, whether they wrongfully failed to disclose this fact; and (3) if they failed to disclose their knowledge, either by covering up the use of the pyrotechnic rounds prior to September 1999 or by obstructing the Office of Special Counsel's investigation, whether a prosecution is warranted. As detailed below, the Office of Special Counsel has concluded that the Jahns knew as early as November 1993 that the FBI had fired pyrotechnic tear gas, that they had a legal duty to disclose this fact, and that they failed to do so.

The Special Counsel also believes that there is sufficient evidence to conclude that the Jahns conducted themselves dishonestly and unprofessionally, and the Special Counsel therefore recommends that the Jahns no longer be permitted to serve as Assistant United States Attorneys. However, for the reasons detailed below, the Office of Special Counsel has concluded that, without additional evidence, it cannot prosecute them for their conduct.

(a) Whether the Jahns knew at any time prior to August 1999 that the FBI had fired pyrotechnic tear gas at Waco on April 19, 1993.

Both Ray and LeRoy Jahn claim that they did not know until August of 1999 that the FBI had used pyrotechnic tear gas at Waco. Ray Jahn admits that the HRT had told him in November 1993 that an HRT member fired "penetrator" rounds at the concrete construction pit, but he insists to this day that he did not know that the penetrator rounds were pyrotechnic in nature. LeRoy Jahn's notes of a November 1993 interview with HRT commander Rogers indicate that the HRT fired "cupcake" rounds with "greater penetrator power" than Ferret rounds, but she too insisted to the Office of Special Counsel that she did not know that these rounds were pyrotechnic.

The Office of Special Counsel finds that the Jahns' claim that they did not know that the HRT had fired pyrotechnic tear gas rounds lacks credibility. The following facts support the conclusion that the Jahns knew that the HRT fired pyrotechnic tear gas rounds at Waco on April 19, 1993.

(1) Visit to Quantico in November 1993. In November 1993, the entire criminal prosecution team went to HRT Headquarters in Quantico, Virginia, to interview HRT members. One of the principal purposes of the visit was to hear the HRT's response to the allegations contained in a film entitled Waco: The Big Lie. In this film, producers showed footage of an FBI agent shooting a grenade launcher, followed by "smoke" rising from the concrete construction pit just after 8:00 a.m. on April 19, 1993, and cited the "smoke" as evidence that the FBI started the fire. The trial team showed the video to a group of HRT members and then broke into groups to interview HRT members to determine, among other things, what had caused the "smoke." The

issue of whether the FBI had used pyrotechnic or incendiary devices was, therefore, significant to the prosecutors when they went to Quantico.

The Office of Special Counsel has reviewed notes from several prosecution team members that indicate that HRT member David Corderman told some team members that he had fired "incendiary" military tear gas rounds at Waco. First, paralegal Reneau Longoria took notes from the interview of Corderman indicating that he identified the rounds as incendiary in nature. Longoria's notes state that the smoke in *The Big Lie* movie resulted "when these guys tried to shoot gas into the bunker (military gas round)/Dark grey bubblehead w/ green base/1 military round and 2 others." She then drew an arrow from the word "military" to a misspelling of the word "incendiary." Similarly, Lancaster's notes, apparently of the Corderman interview, state in relevant part: "Corderman—military gas round at the liner—fired 1-4 incendiary rounds."

stating "Charlie– one green military (incind) Smoke."

There is reason to believe that LeRoy Jahn was also present at the Corderman interview along with Lancaster. Although he states that he cannot remember if he was present, Lancaster took notes that indicate that he probably attended this interview. According to the schedules prepared before the interviews, LeRoy Jahn and Lancaster were slated to interview the Charlie Team, including Corderman. Indeed, while preparing for the interviews that would occur the following day, LeRoy Jahn personally wrote next to the Charlie Team, "John/LeRoy Tues. 5:00." Because the Office of Special Counsel has Lancaster's notes that appear to be from the interview, it follows that LeRoy Jahn was probably present as well. Although the Office of

Special Counsel has not seen any notes taken by LeRoy Jahn regarding the Corderman interview, neither she nor Ray Jahn will certify— as the Department of Justice has requested— that they have provided all of their documents concerning Waco to the entities that have requested them.

Additionally, Lancaster recalled during one of his interviews by the Office of Special Counsel that, during the interview of Rogers, at which both Ray and LeRoy Jahn were present, Rogers referred to the use of a "cupcake" round to penetrate the construction pit.

According to Lancaster, LeRoy Jahn asked Rogers, "What is a cupcake round?" and Rogers replied either that a cupcake round was a military munition or a pyrotechnic munition. Longoria's interview notes indicate that Rogers said that it was a military tear gas round. While Lancaster does not remember the exact words that Rogers used, Lancaster told the Office of Special Counsel that he believes that Rogers or other members of the HRT made the pyrotechnic nature of the military rounds quite clear during these 1993 interviews.

Also, notes from the Rogers interview indicate that Rogers stressed that the concrete construction pit was filled with water when he explained why he gave permission to try the military rounds. This fact is relevant only to the fire-producing characteristic of military rounds, lending credence to Lancaster's statement that HRT members made the pyrotechnic nature of the rounds clear during their interviews. Finally, LeRoy Jahn's own notes from Quantico indicate that Supervisory Special Agent Stephen McGavin specifically told her that certain military rounds were pyrotechnic when he explained why the HRT could not use some rounds obtained from other FBI offices when the supply of Ferret rounds ran low. This information should have alerted her that the military rounds described by Rogers (who was interviewed after McGavin) were also pyrotechnic.

(2) Preparation for the Criminal Trial. The notes taken by members of the criminal prosecution team at Quantico, therefore, provide strong evidence that prosecution team members knew that the HRT had fired pyrotechnic tear gas at Waco. The subsequent conduct and strategy of the prosecution team as it prepared the case for trial further support this understanding. LeRoy Jahn told the Office of Special Counsel that, after the Quantico interviews, the entire criminal prosecution team met to determine which HRT members it would call at trial. The criminal prosecution team determined that they would not call in their case in chief any HRT members that had knowledge of the use of pyrotechnic rounds on April 19.

As the team prepared for trial after the Quantico trip, Longoria prepared a chart summarizing the key information received from the HRT members. The entire trial team reviewed this chart. Under "Corderman" the chart states: "smoke on film came from attempt to penetrate bunker w/1 military 2 ferret rounds, Military was grey bubblehead w/green base."

Both charts—
— indicate that the team had decided that Corderman would only be a "rebuttal" witness. The Office of Special Counsel has located a handwritten note of LeRoy Jahn's that also identifies Corderman as a rebuttal witness. Designating Corderman as a rebuttal witness meant that the prosecution had decided not to call him to testify in its case in chief. Rather, the team decided to call him to testify only if attorneys for the Davidians made the "smoke" coming from the concrete construction pit an issue at trial. According to members of the trial team, Ray and LeRoy Jahn knew of the decision to make Corderman a rebuttal witness. The decision to leave the firing of military rounds for rebuttal testimony suggests that the criminal prosecution team

thoroughly discussed the issue and understood the precise source of the "smoke" on *The Big Lie* film– a pyrotechnic military tear gas round.

In sum, the facts and circumstances discussed above undermine the Jahns' claim that they had no idea that the military tear gas rounds fired by Corderman were pyrotechnic. The Jahns went to Quantico in part to investigate allegations that the FBI had started the fire. FBI witnesses explained to the prosecution team that the military rounds were "incendiary." The Jahns then attended a strategy meeting of their team at which the military rounds were a specific subject of discussion. Finally, the Jahns participated in the decision to save that information for rebuttal. The logical conclusion from these facts is that the Jahns knew in 1993 that the FBI had fired pyrotechnic munitions at Waco.⁶¹

(3) Conduct of the Jahns During the Investigation by the Office of Special Counsel. The obstructive conduct of the Jahns during the course of the investigation by the Office of Special Counsel provides additional credence to the Special Counsel's conclusion that the Jahns learned in 1993 about the firing of pyrotechnic tear gas rounds at Waco. When information about the pyrotechnic rounds became public in August and September 1999, the Jahns took affirmative steps to conceal their knowledge of the firing of these rounds, to persuade other witnesses that

⁶¹The Office of Special Counsel similarly concludes that other members of the trial team also knew that pyrotechnic tear gas rounds were used on April 19, 1993. Longoria's notes, which use the word "incendiary," indicate that she knew.

Lancaster, to his credit, is the only member of the trial team who readily admitted that he was aware of the pyrotechnic nature of the military rounds. Phinizy maintains that he did not learn about the pyrotechnic rounds in 1993. Phinizy recalls being told by LeRoy Jahn not to worry about the "smoke" in the film because it was just tear gas and did not start the fire. Therefore, the Office of Special Counsel cannot conclude that Phinizy knew the rounds were pyrotechnic.

they knew nothing about the use of the rounds, and to shift blame for their non-disclosure to others. Specifically, the Jahns engaged in the following conduct:

I. As stated above, the Jahns refused to sign a certification that they had provided all of their records concerning Waco to the Department of Justice, despite two requests by the Department of Justice that they do so.

II. In a teleconference with Richard Scruggs in the fall of 1999, the Jahns assured Scruggs that they knew nothing about the use of military rounds at Waco. Shortly thereafter, they telephoned Scruggs and said that Bill Johnston had known about the rounds. They then faxed to Scruggs the notes and trial preparation charts of Longoria which reference the military rounds and their incendiary nature and which suggest that Johnston learned this information in 1993.

Although the Jahns told Scruggs that they had not seen these documents until 1999, the Office of Special Counsel has established that, at a minimum, they had seen the witness preparation chart in 1993.

III. In response to an August 1999 e-mail from Ray Jahn to Lancaster about the issue of pyrotechnic rounds, Lancaster called Ray Jahn and made a statement that the trial team did in fact know about the pyrotechnic devices in 1993. Jahn replied in an angry voice that if Lancaster recalled anything about the firing of such devices, he was the only one on the trial team who remembered it. Later, Ray Jahn denied to the Office of Special Counsel that this exchange with Lancaster had occurred, but LeRoy Jahn confirmed that it had in fact occurred.

IV. In August of 1999, the Jahns called Phinizy and suggested to him that they had not been present at the relevant HRT interviews in 1993. They further stated that Bill Johnston

had served in the military, implying that only he should have known that a military round was pyrotechnic. They neglected to tell Phinizy that Ray Jahn also had served in the military.

V. At the conclusion of the first interview of Ray Jahn by the Office of Special Counsel, the Deputy Special Counsel explained to Ray Jahn the importance of not communicating with other witnesses in order to allow the Office of Special Counsel to interview witnesses without their having been prepared or coached. Ray Jahn indicated that he understood the concern raised by the Deputy Special Counsel. Jahn also told the Deputy Special Counsel that he had not contacted Reneau Longoria because to do so would "look bad." Yet, despite the admonition, within a few days, the Jahns returned a call from Longoria. Instead of declining to talk to Longoria, the Jahns coached her on how to handle her interview with the Office of Special Counsel. For example, they "reminded" her that she had been teamed up with Bill Johnston for some of the critical interviews, and told her that she should ask for documents if she did not recall facts, knowing that at least some documents implicated Johnston and that these documents might deflect attention away from them. They further told her that if she did not recall an incident, that was all right. Possibly as a result, Longoria was evasive in her first interview with the Office of Special Counsel, even professing not to be able to identify notes in her own handwriting. Eventually, Longoria told the Office of Special Counsel that she felt that the Jahns had been trying to manipulate her in this conversation.

VI. In August 1999, the Jahns called ATF agent Davy Aguilera, who had not heard from the Jahns in several years and did not know them well. After some small talk about family that Aguilera believed to be insincere, the Jahns asked Agent Aguilera whether he had known about the use of pyrotechnic military rounds at Waco. He said that he had not. LeRoy Jahn

indicated that she and her husband did not know either, and the conversation ended. The Office of Special Counsel believes that the Jahns placed this call in an attempt to influence the recollection of this witness.

In sum, the conduct of the Jahns in refusing to certify that they had produced documents, manipulating witnesses, and interfering with the investigation of the Office of Special Counsel, reinforces the conclusion that the Jahns knew about the use of pyrotechnic tear gas rounds at Waco in 1993. Finally, this conclusion is corroborated by a polygraph examination which indicated that Ray Jahn was deceptive in stating that no one specifically told him in 1993 that the FBI had used pyrotechnic or incendiary rounds and in stating that he did not intentionally withhold *Brady* material in 1993.

(b) Whether the Jahns Improperly Failed to Disclose the Use of Pyrotechnic Tear Gas and Whether They Breached that Duty.

While the Office of Special Counsel concludes that the Jahns, along with other prosecution team members, knew in late 1993 that the HRT fired pyrotechnic tear gas at Waco on April 19, 1993, the Order of the Attorney General appointing the Special Counsel requires that the Special Counsel proceed a step further by determining whether any government employee covered up information from any "individual or entity entitled to receive it." Consequently, in order to respond affirmatively to the Attorney General's question, the Office of Special Counsel must establish not only that the Jahns knew about the pyrotechnic tear gas rounds, but also that they improperly failed to disclose this knowledge. For the following reasons, the Office of Special Counsel has determined that the Jahns improperly failed to disclose their knowledge of the FBI's use of pyrotechnic tear gas rounds.

(1) Under the *Brady* case referenced earlier, as well as Rule 3.09 of the Texas Rules of Professional Conduct, Ray Jahn, the leader of the prosecution team (as well as other prosecution team members), had a duty to submit to the attorneys representing the Davidian defendants information that would tend to be exculpatory. Ray Jahn has admitted to the Office of Special Counsel that the issue of who started the fire was relevant to the criminal trial of the Davidians and that the pyrotechnic nature of the military rounds met the *Brady* standard.

Ray Jahn, as the lead prosecutor, had principal responsibility to make the *Brady* disclosure, as did LeRoy Jahn, who took responsibility for filing all *Brady* responses. The Jahns did not disclose to the defense counsel the HRT's use of pyrotechnic tear gas. Moreover, in response to the defendants' particularized request for exculpatory information about government gunfire, Ray Jahn submitted a pleading containing the affirmatively misleading statement that "the government has no evidence that government agents fired gunshots on April 19, 1993, other than ferret [sic] tear gas rounds."⁶²

(2) On July 19, 1995, Ray Jahn testified to Congress about the activities of the FBI and the conduct of the Davidians at Waco. Again, he failed to disclose the FBI's use of pyrotechnic rounds. Further compounding his failure, he again made the misleading statement

⁶²Because the Jahns were the leaders of the trial team and they prepared and filed this pleading, they bear principal responsibility for the decision not to disclose the information about the use of the military rounds. Still, all of the attorneys on the trial team were experienced prosecutors and should not escape criticism for the government's failure to make a proper disclosure, if they knew.

that, "[t]he FBI did not fire a shot, other than the non-lethal ferret rounds which carried the CS gas."63

(3) In 1999 and 2000, the Jahns had yet another opportunity to disclose their knowledge of the FBI's use of pyrotechnic tear gas rounds when they were interviewed by the Office of Special Counsel. They failed to do so. The Office of Special Counsel finds that the Jahns lied to the Office by denying that they knew the FBI had fired pyrotechnic tear gas rounds at Waco, and obstructed the investigation by attempting to manipulate witnesses, and by lying about their attempts to manipulate a witness, as discussed above.

Finally, the Office of Special Counsel notes the serious consequences flowing from the Jahns' failure to disclose this information. The Jahns and other members of the prosecution team had information that they knew contradicted the understanding of their superiors and the understanding of the public that the FBI had not fired pyrotechnic rounds at Waco, yet they did not bring this information forward. Had the Jahns made one phone call to the Office of the Attorney General in 1993 disclosing the inconsequential use of pyrotechnic rounds, they could

⁶³In this section of his statement, Ray Jahn was discussing the law enforcement agents who were on the front line at Waco:

They were brothers and sisters, husbands and wives, mothers and fathers, and sons and daughters; they were little league coaches, band chaperones, scout leaders and members of the family that sits in the next pew at Church. On the 28th of February, two of the ATF agents were newlyweds; several of the ATF agents had candies in their pockets for the children; and many never fired a single shot, even though, once all the evidence was recovered from the compound, it became abundantly clear that the Branch Davidians had possessed a massive arsenal of assault weapons, illegal explosives, and illegal machine guns, as originally alleged in the ATF search and arrest warrants. On the 19th of April, though repeatedly fired upon by the occupants of Mt. Carmel, the FBI did not fire a shot, other than the non-lethal Ferret rounds which carried the CS gas.

have spared the entire nation the baseless suspicion that government agents were responsible for the fire at Waco.

(c) Whether the Office of Special Counsel Can Prosecute The Jahns for Their Misconduct.

The Office of Special Counsel has carefully studied the relevant facts and law and has concluded that the Jahns have committed legal and ethical violations that should result in their losing their status as federal prosecutors. However, the Special Counsel has determined that it cannot prosecute the Jahns criminally for the following reasons:

- (1) The failure of the Jahns to disclose *Brady* material is an ethical and legal violation but not a criminal act.⁶⁴ Moreover, the Jahns did produce a large volume of information to the Davidian defense team, which included both the FBI lab report containing a reference to the casing of a military round, and the photograph of the military pyrotechnic projectile taken at the crime scene. Additionally, at least one of the defense attorneys representing the Davidians knew that the FBI used pyrotechnic tear gas rounds at Waco, and he chose not to make it an issue at trial.⁶⁵
- (2) Similarly, the Jahns' refusal to certify that they have produced all of their Waco-related documents is unacceptable conduct for Assistant United States Attorneys, and the

⁶⁴Although the Office of Special Counsel believes that the prosecution should have explicitly provided this information about pyrotechnic devices to the defense attorneys prior to trial, the Office of Special Counsel expresses no view as to whether the failure to make such a disclosure entitles the defendants to a new trial.

⁶⁵Although the Office of Special Counsel believes that the prosecutors should have informed the defendants explicitly that pyrotechnic tear gas rounds had been used on April 19, 1993, the Office expresses no view as to whether the failure to make such a disclosure entitles the defendants to a new trial pursuant to *Brady*.

Office of Special Counsel cannot imagine any legitimate excuse for their refusal, but it is not a crime.

- (3) The statement that Ray Jahn made to Congress, while misleading, related to the issue of returning gunfire rather than pyrotechnics, and was not material either to the issues that Ray Jahn addressed in his testimony or to the questions that Congress posed to him. The Office of Special Counsel, therefore, believes that this misleading statement was not a crime.
- (4) The conduct of the Jahns during the course of the investigation of the Office of Special Counsel presented a closer call as to whether the Office of Special Counsel should commence a prosecution. The Special Counsel believes that the Jahns lied to investigators of the Office of Special Counsel when they stated that they did not know that military rounds were pyrotechnic. Because the subject of the lie was their state of mind— what they knew in 1993— proving it beyond a reasonable doubt would be difficult. The evidence that the Jahns knew of the pyrotechnic devices is circumstantial— they were the leaders of the team, several members of their team knew, and the notes of their team members suggest that they knew.

the Office of Special Counsel has no notes in the handwriting of the Jahns specifically indicating that they knew that Corderman had fired the pyrotechnic or incendiary military tear gas rounds at the concrete construction pit.

the Office of Special Counsel cannot prove conclusively that the Jahns deliberately concealed documents from its investigation. Their failure to certify creates an inference of nondisclosure, but that again is not enough for a conviction.

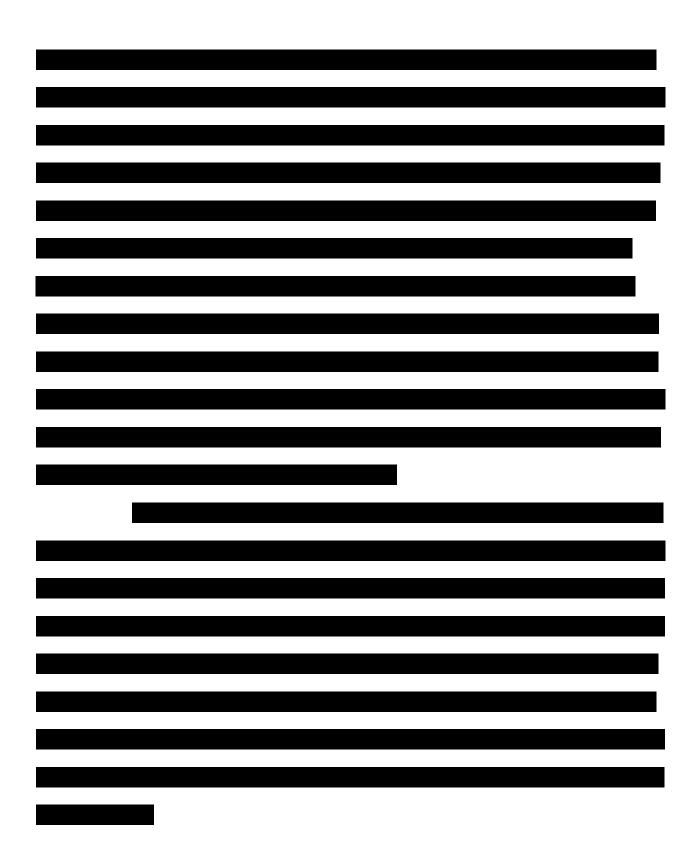
Further still, Rogers, Corderman, and the members of the prosecution team have no specific recollection of who was in what interview in 1993, so it becomes difficult to place the Jahns at the relevant meetings, although the circumstantial evidence again suggests that they were present at least at some of the relevant meetings.

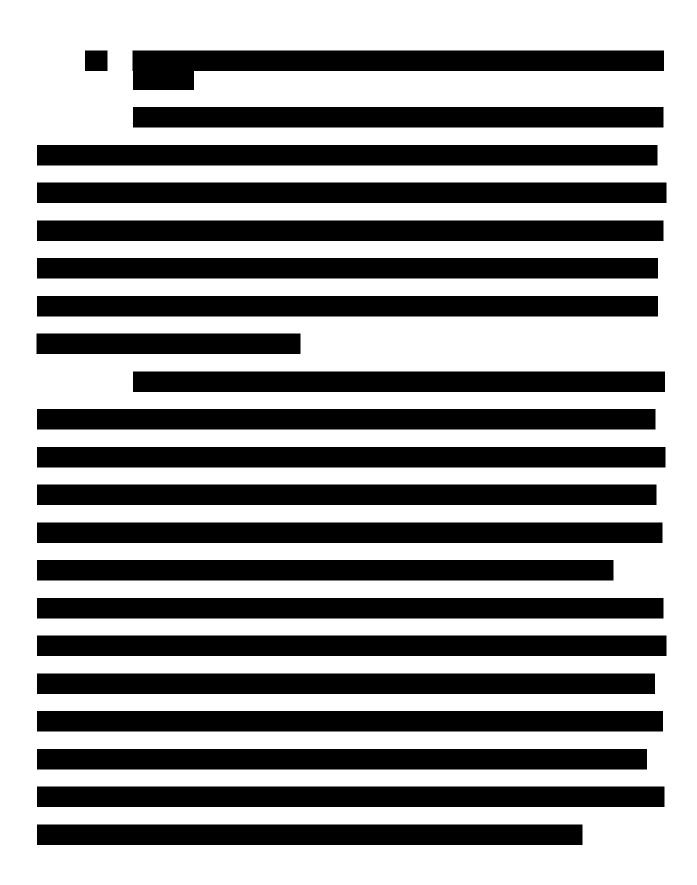
Finally, the polygraph evidence that Ray Jahn was deceptive in denying knowledge of the pyrotechnic rounds would almost certainly be inadmissible to prove that he committed a criminal offense. Because the standard of proof for a criminal prosecution is "beyond a reasonable doubt," the Office of Special Counsel declines to seek an indictment of the Jahns for lying to the Office about their knowledge of pyrotechnic tear gas rounds based only on circumstantial evidence and inadmissible polygraph results.

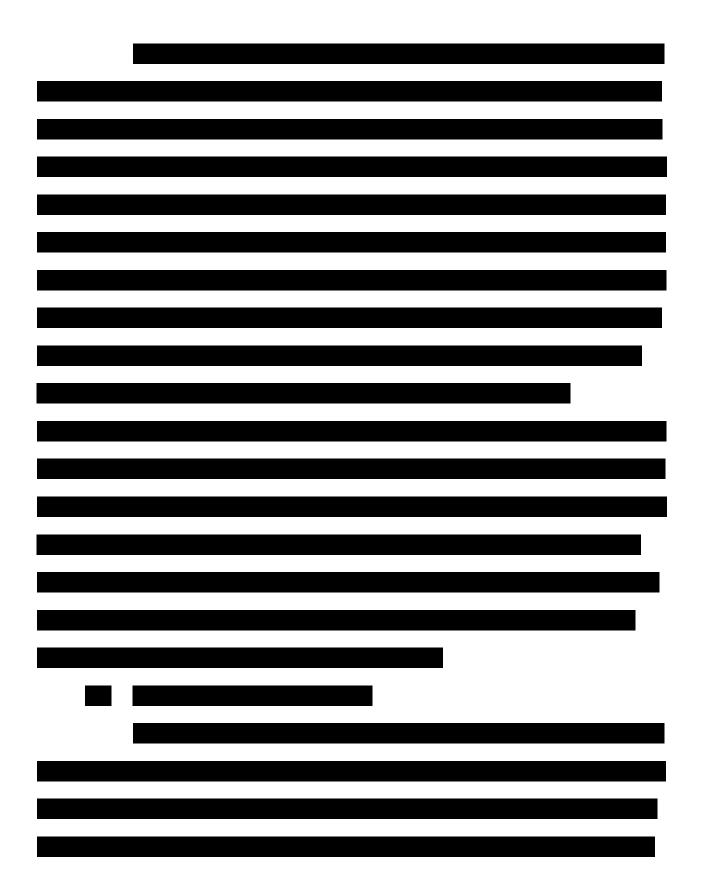
The Office of Special Counsel also considered carefully whether the course of conduct by which the Jahns called and manipulated witnesses constituted obstruction of justice. Again, while reprehensible, the Office of Special Counsel has concluded that obstruction of justice could not be proved beyond a reasonable doubt. First, the evidence of what occurred in these conversations is somewhat ambiguous since none of the participants has a clear recollection of what precisely was said six years earlier. Second, much of the Jahns' egregious conduct, such as the phone calls with Scruggs, Phinizy, Lancaster and Aguilera, occurred prior to the appointment of Senator Danforth as Special Counsel, and therefore could not be prosecuted as obstruction of a pending proceeding. See 18 U.S.C. §1505. The conversation with Longoria did occur during the investigation, but Longoria's account of that conversation, while certainly establishing that the Jahns acted inappropriately, is far too ambiguous to form the basis of a

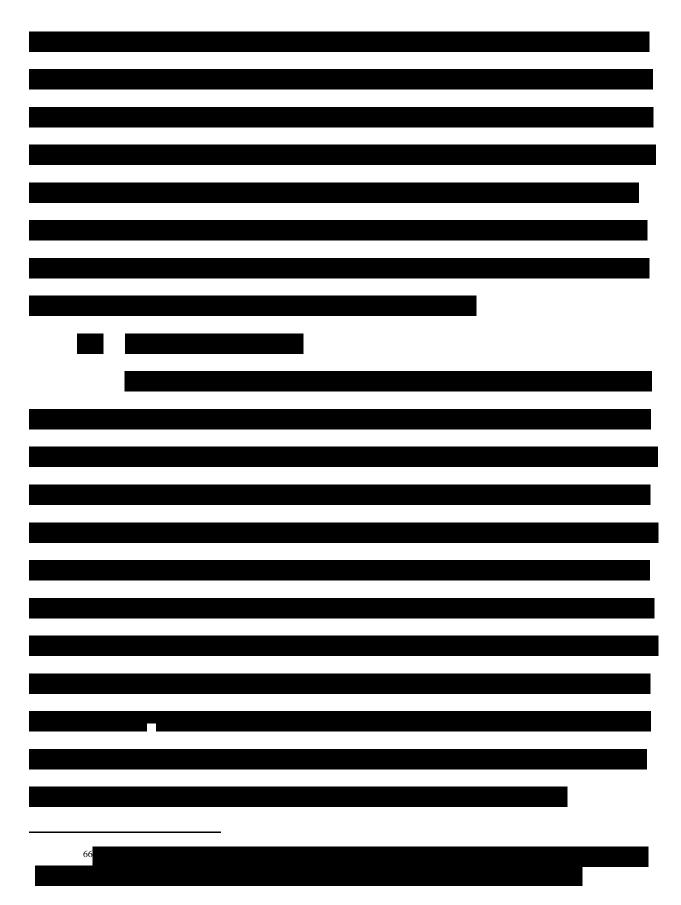
criminal prosecution. Consequently, the Office of Special Counsel declines prosecution and, instead, refers its Report to the Office of Professional Responsibility at the Department of Justice with the recommendation that the Department of Justice preclude the Jahns from serving further in their honored capacity as Assistant United States Attorneys.

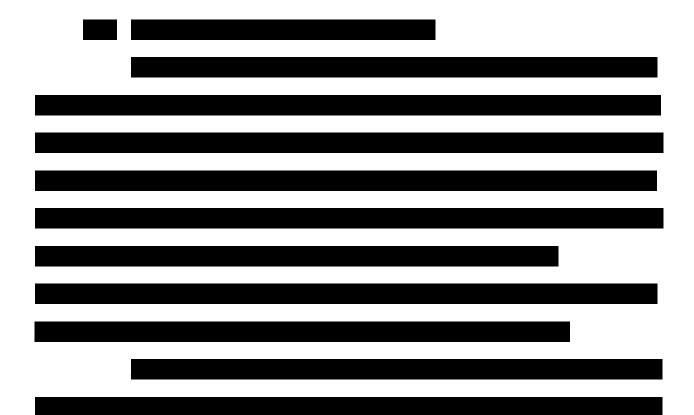
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G. Missing Physical Evidence. As described above, HRT Charlie Team member Corderman fired three M651 pyrotechnic tear gas rounds at the roof of the concrete construction pit at approximately 8:08 a.m. on April 19, 1993. Two of the projectiles landed in a trench outside of the concrete construction pit, and both of them discharged, creating a tear gas cloud. The third projectile bounced off the roof of the construction pit and landed approximately 200 yards northwest of the water tower. Gas from this projectile drifted toward Sierra-2 and was reported by HRT members there. The use of three M651 rounds on the morning of April 19, 1993, generated six items of evidence relating to the incident, three spent *casings* and three spent *projectiles*. Of these six items, only one casing (Q1237) was ever logged into evidence. There are no reports of anyone ever seeing the two other casings. One or more crime scene personnel saw each of the three projectiles, but no one collected them and logged them into evidence.

The absence of five of the six items of evidence relating to the pyrotechnic tear gas rounds is troubling. Although these rounds did not in any way contribute to the fire, their absence raises suspicions as to the way that crime scene investigators handled the evidence. Therefore, pursuant to the Attorney General's Order, the Office of Special Counsel conducted an exhaustive investigation into whether this evidence was "destroyed, altered, or suppressed" by examining all matters related to the processing and collection of the crime scene evidence. The Office of Special Counsel interviewed all of the nearly 250 possible witnesses associated with the crime scene, re-interviewed 32 witnesses; spent approximately 1200 hours analyzing and cataloguing thousands of pounds of evidence in the United States District Court in Waco and at a local warehouse containing numerous large CONEX containers; and studied thousands of photographs and hundreds of hours of videotapes.

The Office of Special Counsel believes that someone removed the evidence from the crime scene, but has been unable to determine whether it was removed for an ill motive. The evidence may have been innocently discarded because it had no relevance to developing a criminal case against the Davidians. However, the Office of Special Counsel cannot exclude the possibility that an individual at the crime scene decided to remove the evidence in order to hide it from the public.

1. There is no evidence of a widespread criminal conspiracy to destroy or hide the physical evidence that the FBI used pyrotechnic tear gas rounds.

The Office of Special Counsel has not uncovered evidence to support a conspiracy involving a group of crime scene personnel, FBI laboratory personnel, or members of the Department of Justice criminal prosecution team in their handling of the pyrotechnic evidence.

The FBI did not control the crime scene at Waco. The Texas Rangers had primary responsibility

for securing the scene and organizing the search for evidence. They were assisted by representatives from the FBI Laboratory, the Tarrant County Medical Examiner's Office, the Houston Fire Department's Arson Division, the United States Attorney's Office for the Western District of Texas, the Texas Department of Public Safety Crime Laboratory, the Texas Highway Patrol, ATF, and the Smithsonian Institution. Although FBI personnel may have had a motive to conceal the evidence of pyrotechnic rounds (since they had publicly announced that no such devices were used), none of the other crime scene participants had any motive to conceal this evidence. While in Waco, the FBI had a poor relationship with other law enforcement agencies involved in the incident. Given the discord between ranking officials in the ATF, Texas Rangers, and the FBI, the state agencies associated with the crime scene search had no motivation to support the FBI's public statements denying the use of pyrotechnics. In fact, some witnesses have suggested that representatives of state agencies may even have been motivated to disclose publicly the existence of the rounds, if found, in order to embarrass the FBI. During the interviews of nearly 250 witnesses from numerous different state and federal agencies who took part in the evidence collection process, no one offered any evidence of any conspiracy to conceal or destroy evidence at the scene.

Another factor weighing heavily against finding a widespread conspiracy is that so many different groups actually disclosed information about these pyrotechnic rounds to others. First, the HRT members told anyone who asked them about the use of the pyrotechnics. Second, the FBI explosives expert who found the two M651 projectiles in the trench next to the construction pit, borrowed a gun from, he believes, a Texas Ranger to render the projectiles safe and then joked with him about how many shots he needed. He also readily told the Office of

Special Counsel about finding the pyrotechnic tear gas rounds. The supervisory FBI agent on the scene, James Cadigan, also voluntarily disclosed the spotting of those two projectiles. Third, the FBI Supervisory Special Agent who was present when the third projectile was found in the field on April 30, 1993, 11 days after the fire, had the item flagged and photographed. The photograph was part of the evidence given to defense attorneys for the Branch Davidians. Fourth, rather than hiding the evidence, an FBI supervisory agent, Richard Crum, transported to Washington, D.C. the one casing that was collected as evidence from Waco. The casing was logged into evidence, assigned a new lab number, and properly analyzed by the laboratory. Fifth, Crum also told Texas Ranger George Turner about the use of the rounds during the criminal trial in 1994. Finally, the 49-page lab report prepared by the FBI lab and provided to the criminal defense and Congress, specifically indicated that the recovered shell was a "fired U.S. military 40 mm shell casing which originally contained a CS gas round."

These facts indicate that there was no systematic attempt to conceal the pyrotechnic evidence.

2. The physical evidence appears to have been removed from the scene.

While there was no widespread conspiracy, the evidence indicates that someone did remove at least two, and probably all three, of the projectiles from the crime scene. As referenced earlier, on April 20, 1993, during an initial walkthrough of the crime scene intended to discover and disarm any explosive devices, Wallace Higgins, the FBI explosives expert, found the two M651 projectiles in the trench next to the construction pit. Believing one of the rounds still contained tear gas, he asked for and received permission from his supervisor, FBI Special Agent James Cadigan, to shoot one of the projectiles to render it safe. Higgins states that he then

borrowed a pistol and shot at the projectile. Neither the Rangers nor the FBI prepared a report of the gunfire at the scene. Although Higgins stated he may have picked up the projectile and looked at it after he shot at it, he did not retrieve the projectiles—since he was not responsible for gathering evidence— and he instead left them in the trench.⁶⁷ No one ever logged these two projectiles into evidence.

Although the projectiles were in the trench on April 20, 1993, they were not there at the end of the crime scene search. No formal search of this particular portion of the crime scene was ever conducted, ⁶⁸ but two Texas Department of Public Safety ("DPS") lab employees have stated they looked into the area of the trench around April 28, 1993. One technician, who walked the area above the trench, did not see the projectiles there. The other technician went into the trench and also never saw the projectiles. Additionally, Higgins, who recalled walking by the trench after the conclusion of the crime scene search, said that he did not see the projectiles that he had previously seen there. Since the two projectiles were in the trench on April 20, 1993, and

⁶⁷Higgins' account, including his insistence that he did not remove the projectiles from the scene, was confirmed by polygraph testing.

⁶⁸On May 3, 1993, a search team led by Rangers Johnny Waldrip and Fred Cummings began to search Sector U, the area just to the left or green side of the complex. As it appears on the sector map, Sector U included the underground construction pit, the ground level area between the construction pit and the water tower and the ground level area to the rear of the construction pit, including the trench where Higgins saw the two projectiles. The search team apparently misunderstood Sector U to include only the underground area and never officially searched the above ground area. The Ranger crime scene search report refers to the sector only as an underground area and includes a drawing of the sector excluding the ground level portion of the sector. As a result, no crime scene searcher remembers searching the ground level portion of this sector and no articles of evidence contained in the evidence database were collected from this portion of Sector U.

were not there two weeks later, someone must have removed them from the crime scene during the interim.

On April 30, during a "line search" involving 53 law enforcement officials who lined up fingertip to fingertip and searched the area outside the main structure of the complex, an FBI supervisory special agent was present when the third M651 military tear gas projectile was found approximately 200 yards northwest of the water tower. Someone then flagged the item for recovery and a Texas DPS photographer photographed the projectile. The FBI agent summoned either Crum or Cadigan to the area to show the projectile to one of them. This projectile was never inventoried as evidence, and extensive searches since have failed to locate it. The photograph was, however, in the binders of photographs produced to the Davidian criminal defense attorneys. While it is possible no one ever retrieved this projectile due to the tall grass, its distance from the burnt remains of the complex, or some other reason, since it was flagged, someone in all likelihood picked up the projectile and discarded it.

The disappearance of these three projectiles does not necessarily mean that they were concealed or discarded for some evil purpose. Crime scene personnel may have treated these three projectiles similarly to other pieces of ammunition found on the scene and innocently discarded them. The Jahns and other officials instructed the search teams to collect evidence to assist in proving the *government's* case against the Davidians. Because the crime search personnel were collecting evidence for the murder and firearms case against the Davidians, the search teams may not have considered evidence that the FBI fired tear gas at the complex on April 19 as probative of any relevant issue at the time. When the focus was on prosecuting the Davidians, search teams may not have viewed the pyrotechnic rounds as significant.

In a crime scene as large as the Davidian complex, discarding "non-probative" evidence was part of the established protocol. The Office of Special Counsel knows, for example, that only some of the Ferret casings were recovered from the scene and logged into the database. Many were simply thrown away.⁶⁹ This procedure was a discretionary decision made by the onscene agents who were attempting to collect as much evidence as possible under extraordinary circumstances.⁷⁰ Therefore, the searchers may very well have discarded the projectiles, along with the other "non-probative" material into the dumpsters located on the scene.

On the other hand, the absence of five of the six items which would have shown the use of pyrotechnics remains disconcerting. The Office of Special Counsel cannot exclude the possibility that someone at the crime scene decided to remove the evidence in order to benefit the FBI. An extensive investigation has uncovered no evidence to identify any individual who did so, however, so the Office cannot conclude that anyone disposed of these pieces of evidence for improper purposes.

⁶⁹As described above, one casing from a pyrotechnic tear gas round was collected, logged into evidence, and properly analyzed by the FBI lab as item Q1237. The Office of Special Counsel has received no evidence that the other two shells were ever located. The Bradley vehicle from which the rounds were fired never was part of the crime scene search. Crime scene searchers may well have thrown the casings for the military rounds away with the Ferret casings that they discarded.

⁷⁰The Waco crime scene was unprecedented in size and scope. The difficulty of the search was compounded by the fire, which destroyed much of the evidence and buried other probative evidence under the collapsed structure of the complex. The remains of the Davidians caught in the fire were burned and charred, some beyond recognition. Identifiable burned body parts were commingled with body parts from other individuals when the structure collapsed on itself. Hundreds of weapons had been burned in the fire, leaving only the charred frames of the guns. Hundreds of thousands of rounds of ammunition were also found in and around the complex. An untold number of rounds were "cooked off" during the fire. Among this massive assortment of firearms, bodies, live ammunition rounds, spent rounds, and approximately 380 Ferret casings spread over 77 acres, were the six component parts of the pyrotechnic rounds.

In the interest of completeness, however, the Office of Special Counsel must state that the conduct of two of the FBI's lead agents at the crime scene causes it concern. As discussed above, FBI agent Higgins discharged a weapon at the crime scene in an attempt to render safe one of the pyrotechnic tear gas rounds. The Office of Special Counsel has determined that shooting at a tear gas round to render it safe is not standard FBI protocol and is an unusual practice, but it is not in violation of any rules or regulations. However, FBI regulations have long required the reporting and investigating of each incident where an agent discharges a weapon. See Manual of Investigative Operations §12-1.9, "Reporting of Shootings," as revised March 1990. No one reported this shooting. Agents Cadigan and Crum, who were the FBI supervisory agents for the crime scene search, knew that Higgins discharged a weapon at the crime scene but never reported the incident and did not require Higgins to do so.

Moreover, during and after the crime scene search, Cadigan made extensive notes of his observations and his work effort concerning the search of the complex during April and May of 1993. On the first page of his notepad, Cadigan made a clear reference to the shooting incident and wrote, "Wally found a live 40 mm gas grenade - he disabled it- Took 4 shots."

Cadigan did not maintain the notepad with his other Waco records in his office, but rather kept it at his home in his attic. Cadigan did not produce this notepad to the prosecution team during the criminal trial; consequently, the notes were not produced to the defense attorneys when Cadigan testified during the trial (as required by the Jencks Act, 18 U.S.C. § 3500). Further, in 1999, when FBI officials sent several requests throughout the FBI seeking all Waco-related documents, Cadigan produced all of his Waco records except this notepad. Cadigan did voluntarily produce the notepad to the Office of Special Counsel in September 2000.

Putting notes relating to one of the most significant investigations in FBI history, in an attic is highly suspicious, and Cadigan's failure to disclose these notes prior to this year was in violation of the Jencks Act in 1994, and in violation of the congressional subpoena and court order requiring the production of Waco-related material at the time. Cadigan was unable to provide any reasonable explanation for the late disclosure. Such conduct is completely unacceptable for an FBI agent, and the Office of Special Counsel will refer the Cadigan matter to the FBI's Office of Professional Responsibility for appropriate action.

pursuing criminal charges against Agent Cadigan for several reasons. First, although late,
Cadigan voluntarily turned over his notepad at a time when the Office of Special Counsel was
unaware of its existence. Second, the information in the notepad is consistent with what Cadigan
told the Office of Special Counsel. He did not hide the document and then tell a story which was
contradicted by the document,

Third, failure to turn over the notepad
does not appear to be an attempt to obstruct the Special Counsel's investigation. Long before he
turned over the notepad, Cadigan had disclosed to the FBI liaison for the Office of Special
Counsel the existence of the pyrotechnic tear gas projectiles found near the concrete construction
pit. For all of these reasons, the Office of Special Counsel does not believe that Agent Cadigan
was obstructing its investigation or hiding information about the pyrotechnic rounds from this
Office. Finally, if he intentionally concealed the notepad because he failed to report the shooting
incident, then this is an internal FBI matter and outside the mandate of the Office of Special
Counsel.

While the Office of Special Counsel does not find that Cadigan obstructed its investigation, the Office has a different view of Agent Crum. The Office of Special Counsel believes that Crum, the crime scene "foreman" responsible for collecting evidence for the FBI, lied to the Office during the investigation. During his interviews, Crum was evasive, and his statements, even concerning innocuous matters, were unbelievable. Specifically, the Office of Special Counsel refers to the following points in support of its conclusions:

- (a) During the crime scene search, Cadigan kept notes of the remarkable events in his notepad. In particular, he noted that Higgins had fired four gunshots at a 40 mm tear gas projectile in order to render it safe. Crum reviewed Cadigan's notes and in fact made handwritten changes and corrections to the notes, yet Crum claims to have had no recollection of this event.
- (b) When Texas Ranger Turner found a casing on the scene, he recalled that he showed the casing to Crum and that Crum replied, "I don't know what it is, but I will find out and get back to you." Crum said that he had no recollection of this event either.
- (c) Ranger Turner later spoke to Crum at the criminal trial and Crum told

 Turner that the casing was from an explosive military round, that the FBI

 was authorized to fire the round, and that the round was used to penetrate a

 door to the concrete construction pit. This conversation indicates that

 Crum had at least one conversation with some knowledgeable source prior

 to speaking to Turner. Crum claimed to have no knowledge of any of these

- conversations, although he acknowledged that Ranger Turner was an honest man and that he would credit Turner's recollection.
- (d) In August 1993, LeRoy Jahn asked Crum to transport personally the shell from Waco to the FBI Lab in Washington. This is the only piece of evidence that Crum personally delivered, and the request to do so was highly unusual. The Office of Special Counsel is unaware of any other piece of evidence that the FBI transported in such a manner. Crum prepared the required paperwork and hand-delivered the item. Yet, when asked about the item, Crum again claimed that he had no recollection of this event.
- (e) A polygraph examiner determined that Crum was "deceptive" when he denied knowledge of the pyrotechnic military rounds.

The Office of Special Counsel gave very serious consideration to the possibility of bringing criminal charges against Agent Crum for obstructing the investigation. However, the Office of Special Counsel has determined that there is insufficient evidence to prove a criminal case beyond a reasonable doubt. While the Office of Special Counsel suspects that Crum lied to conceal his knowledge of the missing evidence, the investigation was unable to uncover corroborating evidence which would establish that Crum participated in or had knowledge of the disappearance of the pyrotechnic tear gas projectiles. In fact, although he claims not to remember, he did transport the shell to the FBI lab to be analyzed and did discuss the round with Ranger Turner in 1994. Both those actions would indicate he was not trying to conceal the evidence. These facts would make an obstruction case very difficult to prove in court.

Additionally, Crum did not deny that the events occurred. Rather, he simply claims not to remember them. A dishonest claim of lapse of memory is very difficult to prove when dealing with events seven years in the past. Additionally, Crum's failure of a polygraph examination is not likely to be admissible in a criminal trial.

Although Crum cannot be prosecuted, he should not be an FBI agent. Following his last interview with the Office of Special Counsel, Crum voluntarily retired from the FBI, so the Office of Special Counsel cannot recommend that further action be taken.

H. <u>Civil Trial Team</u>. In February 1996, an HRT member wrote a memorandum to an FBI attorney, Jacqueline Brown, discussing the use of military rounds and their potential for causing fires. The Office of Special Counsel devoted considerable resources to determining why the responsible government officials did not disclose this information in the civil case or to the public until August of 1999. The short answer is that the FBI attorney failed to pass the memorandum on to the Department of Justice.

In January 1996, Marie Hagen, the Department of Justice attorney responsible for the defense of the civil case, asked Jacqueline Brown, the FBI attorney assigned to the case, for help in responding to a declaration filed by an expert for the Davidians and their families who alleged that the HRT had fired "at least one 'military round' in an effort to penetrate the construction pit." Brown faxed the declaration to the FBI chemical agent specialist. The declaration was also provided to HRT Special Agent Robert Hickey who discussed the particular areas of concern with Brown. On February 15, 1996, Hickey drafted a memorandum to Brown which clearly stated that the HRT had fired two or three military tear gas rounds at the "underground shelter" early in the morning and explained that these rounds could not be used

elsewhere in the complex "due to their potential for causing fire." Brown received a draft of the memorandum on February 16, discussed it with Hickey, and made notations regarding this key passage on her copy of the memorandum.

The Department of Justice did not specifically respond to the plaintiffs' expert's allegations regarding the military rounds in February 1996. In 1997, counsel for the Davidians and their families filed a supplemental declaration by the same expert which reiterated the allegation that the government had fired pyrotechnic tear gas rounds on April 19, 1993. Again, the Department of Justice did not respond factually to the allegation. When the issue was again briefed in 1998, however, Hagen signed a pleading which stated in a footnote that:

The degree to which plaintiff's expert testimony is based on speculation is demonstrated by Mr. Sherrow's conclusion that the 40 mm ordnance found within the compound "probably was fired by the U.S." because "it could be fired only from a military weapon and civilian possession of these weapons is severely restricted." This statement is extraordinary in that it ignores the virtual arsenal gathered by the Davidians, including two .50 caliber anti-tank guns.

While this footnote is not technically false, it is misleading in that it fails to acknowledge that the HRT did fire military tear gas rounds on April 19. Brown briefly reviewed this pleading before it was filed.

The key question is whether Brown told Hagen or anyone else about the information regarding military tear gas rounds contained in the Hickey memorandum. Although Brown insisted to the Office of Special Counsel that she gave the information regarding the use of military rounds to Hagen and to Brown's supervisor at the FBI, the evidence indicates that she did not.

First, the only evidence that Brown told Hagen about the Hickey memorandum is Brown's own statements. Brown's assertions are contradicted by the clear testimony of numerous witnesses and, more importantly, by her own later statements. The Office of Special Counsel interviewed Brown on four different occasions during which Brown gave several different accounts of her actions with respect to the Hickey memorandum. Even before the appointment of the Special Counsel, Brown asserted to several colleagues at the FBI that she was certain that she had faxed the Hickey memorandum to Hagen, an assertion that was belied by the absence of a fax cover sheet in her meticulously documented files. In a subsequent interview with the Office of Special Counsel, Brown denied having said that she remembered faxing the memo to Hagen. In another interview, Brown claimed that she had read key portions of the Hickey memorandum to Hagen word for word over the phone. She also claimed that she had discussed the memorandum and the use of military tear gas rounds with Hagen again in 1997 after the Davidians filed the supplemental expert declaration. Hagen had no memory of any such conversations, and ultimately Brown, too, conceded that she had no specific memory of talking to Hagen about pyrotechnic military rounds before August 1999. Brown also claimed that she had discussed the Hickey memo with her immediate supervisor, Virginia Buckles. Buckles denied that Brown had told her about the Hickey memo, and, again, Brown ultimately told the Office of Special Counsel that she did not, in fact, recall speaking to Buckles about the Hickey memo or the FBI's use of military rounds. In short, Brown repeatedly made inconsistent, self-serving, misleading, and false statements to the Office of Special Counsel. Her assertion that she told Hagen or anyone else about the use of military tear gas rounds at Waco, therefore, lacks credibility.

Second, the documentary evidence also indicates that Brown did not give the information to Hagen. As stated above, neither Brown nor the Office of Special Counsel was able to locate a fax cover sheet indicating that she had faxed the Hickey memo to Hagen. Hagen's files contain no copy of the Hickey memo. In addition, Brown's "To Do" list in her calendar for February 19, 1996, contains the notation, "Sherrow Declaration Memo to M[arie] H[agen]." Unlike some diary entries, this "To Do" item is not checked off. Moreover, Brown placed a number on the Hickey memorandum which would result in its being placed in an FBI litigation file that would not be disclosed to the Department of Justice.

Brown clearly lied to the Office of Special Counsel during the course of this investigation. Her efforts to avoid blame in this matter have wrongly and unfairly cast suspicion on Hagen and on Brown's own superiors at the FBI. Her misleading statements have wasted countless hours and investigative resources. What the Office of Special Counsel has found is one FBI attorney's attempt to cover up her own misconduct. While this is reprehensible, it is not the principal focus of this investigation. Therefore, the Office of Special Counsel declines to pursue a criminal prosecution,⁷¹ but has forwarded the matter to the Department of Justice Office of Professional Responsibility for appropriate action.

I. <u>Undisclosed Morning FLIR</u>. Until September 1999, the government repeatedly denied the existence of FLIR tapes preceding 10:42 a.m. on April 19, 1993. These early morning tapes are significant evidence in that they contain the audio of HRT commander Rogers

⁷¹As mitigating facts, the Office of Special Counsel notes that Brown did not destroy copies of the memorandum, and instead kept at least three copies in FBI files. Nor did she ask Hickey to change his statements about the use of military rounds. Indeed, Brown's diary entry could indicate that she did intend to give the information to Hagen, but simply failed to do so.

authorizing the firing of the military tear gas rounds and the Charlie Team reporting that the military tear gas rounds bounced off the concrete construction pit. The issue investigated by the Office of Special Counsel was where the original morning FLIR tapes have been since April 1993 and why the government repeatedly and incorrectly denied their existence.

On April 19, 1993, the Nightstalker aircraft containing the FLIR recording equipment began recording at 5:58 a.m. After landing at 9:30 a.m., an FBI aviation specialist removed at least one set of original tapes, and possibly both sets, from the aircraft and turned them into the FBI Command Post at the airport hanger. These tapes were not turned over in discovery during the criminal trial or to Congress when Congress requested them during the 1995 hearings. Additionally, in response to numerous Freedom of Information Act ("FOIA") requests from David Hardy to the FBI dating from 1995 to 1997, which specifically sought all FLIR tapes from April 19, 1993, the government repeatedly denied that any FLIR tapes existed from April 19, 1993, prior to 10:42 a.m., and only produced the two FLIR tapes beginning at 10:42 a.m.

The Hardy situation is the most troubling. In May 1997, Hardy or his attorney specifically requested the early morning FLIRs in three separate letters. One letter stated that "[t]he earliest of the FLIR tapes provided begin about 10:42 A.M., yet we know that FLIR tapes were made going back to before 6:00 A.M. [W]e would suggest you speak with the FLIR operators, including Arnold L. Ligi, who were drawn from the FBI's Aviation Special Project

⁷²The aviation specialist does not recall signing anything when he turned in the tapes and no FBI evidence form or "green sheet" relating to these tapes has been located. A "green sheet" is an FBI Form FD-192, an evidence form that includes the case, the date property was acquired, from whom it was acquired and a description of the evidence. Each time custody of the item is transferred, the FD-192 requires a signature and date. One set of FLIR videotapes from the second shift, beginning at 10:42 a.m. were green sheeted and maintained as evidence.

Group." Another letter suggested that Assistant United States Attorney Ray Jahn may have information because "[o]ne of the defense attorneys informs me that Ray Jahn indicated that the FLIR was on back into the predawn hours"

As a result of these letters, the FBI paralegals responsible for gathering the materials in response to the FOIA request made further inquiries to determine if there were FLIR tapes prior to 10:30 a.m. Notes indicate that they reviewed at least one FBI 302 memorandum from a pilot on the second shift of the Nightstalker aircraft which began recording at 10:42 a.m. However, there is no evidence that anyone at the Department of Justice or FBI looked for any further 302's from the pilots or FLIR operators on April 19, 1993. Had they looked for the documents, these 302's would have clearly indicated that there were two crews on April 19, 1993, and that the Nightstalker was in the air during the "initial stages" of the operation.

The paralegals also contacted Aviation Specialist Arnold Ligi and wrote a memorandum which stated: "Hardy has made this allegation (that the FLIR surveillance on 4/19/93 began earlier than the videos that we have provided) before in his attorney's letter of 5/29/97. Pursuant to his attorney's letter, we checked with Ligi (the FBI employee cited by his attorney) and Ligi stated that the FLIR surveillance did **not** begin any earlier." (Emphasis in original.) Ligi denies that he would have made such a statement. One of the paralegals also spoke to Ray Jahn, who told the paralegal that he thought the plane had gone up before 10:30 a.m., but was willing to go along with whatever time was on the FLIR tapes.

As a result of these inquiries the FBI concluded that there were no FLIR tapes prior to 10:42 a.m. and considered the issue closed. In a letter to Hardy, dated June 17, 1997, the FBI stated:

In response to the first issue in the letter of your attorney, we contacted the FBI employee named in the letter and he advised us that the earliest FLIR videotape was not recorded at 6:00 a.m., but rather at the approximate time (10:42 a.m.) indicated by your attorney as the earliest FLIR videotape released to you. Please be advised that all FLIR videotapes recorded on April 19, 1993, have been released to you pursuant to your FOIA request.

This statement was repeated in several pleadings and in a declaration signed by the FBI Special Agent in charge of FOIA Litigation Unit.

In late August 1999, the HRT located one of the early morning FLIR tapes at its headquarters and forwarded it to the FBI General Counsel's Office. Jacqueline Brown reviewed an index which listed the tape, recognized its significance and passed the information on to her superiors. A few days later, on September 1, the FBI located two additional tapes at the Aviation Special Operations Unit ("ASOU"). Experts retained by the Office of Special Counsel concluded that all three of the tapes discovered in September 1999 are original early morning FLIR tapes. It is, therefore, troubling that three original FLIR tapes were missing and not located and made public until August and September 1999. No one can state with certainty where these three FLIR tapes were between the time that they were turned in to the command post on April 19, 1993, and the time that the FBI located them in 1999. It is clear, however, that an original tape of an FBI operation that ultimately resulted in the deaths of over 80 people should have been treated as evidence and handled as such. The FBI failed to establish the proper chain of custody for these tapes.

With respect to the FLIR tape found at HRT, the Office of Special Counsel has found no one who will say how or when the tape arrived at HRT. The agents in charge of the Waco materials admit that the FBI records system was "awful" and no inventory of material was ever made. In response to the FOIA request for FLIR tapes, no one ever asked HRT to search for

FLIR tapes because the personnel conducting the search did not expect to find FLIR tapes at HRT, since the Nightstalker was an aviation operation.

It is even more troubling that the two tapes located at ASOU were not found until September 1, 1999. The supervisory aviation specialist in whose file cabinet they were found stated to the Office of Special Counsel that he did not know that they were there. ASOU was asked on several occasions, however, to search for any FLIR tapes or other material from Waco. FBI agents and employees claim that they performed several searches, but apparently never searched the filing cabinet where the tapes were located. The only explanation provided for the failure to produce the tapes is that the label says "Nightstalker 4/19/93" and does not say "Waco." Of course, FBI's only operational Nightstalker aircraft was in Waco on April 19, 1993, a date that those conducting the search should have recognized.

As negligent as this cavalier approach to congressional subpoenas and FOIA requests may have been, the Office of Special Counsel does not believe that the FBI's failure to disclose the early morning FLIR tapes was the result of any intentional effort to conceal them. In fact, had individuals at the FBI intended to conceal this evidence, they could have simply destroyed the tapes rather than preserving them for six years with the label "Nightstalker 4/19/93." It is probable that the failure to produce the early morning FLIR was the result of the failure of ASOU, or someone at ASOU, to conduct proper searches when asked to do so. Additionally, those persons responsible for the FOIA inquiry did not conduct an exhaustive⁷³ search as they failed to speak to anyone at ASOU besides the one pilot and failed to examine all FBI 302s, which

⁷³Of course, FOIA only requires a reasonable search, and this Report makes no conclusion about whether the search was reasonable.

would have established that the Nightstalker was flying during the "initial stages" of the April 19, 1993, operation. Finally, some responsibility lies with those who failed to treat and document the early morning FLIR tapes as evidence. The Office of Special Counsel concludes, therefore, that the government's failure to produce the early morning FLIR tape until September 1999 was negligent, but not a criminal cover-up.

- (a) The FBI did not mislead Attorney General Reno in order to persuade her to approve the tear gas plan. The Office of Special Counsel investigated allegations that the FBI misled Attorney General Reno about the conditions in the complex and the status of negotiations in order to convince her to approve the tear gas plan. These allegations are entirely baseless. The Office of Special Counsel has interviewed all of the witnesses who attended meetings with Attorney General Reno during the days prior to her approval of the plan and has reviewed the documents that were provided to her and her staff. The FBI briefed Attorney General Reno fully and fairly on the conditions at Waco. The FBI provided her all of the information that she requested, and the FBI diligently followed up on the questions that she raised. Indeed, Attorney General Reno maintained during her interview with the Special Counsel that she was apprised of all material facts, and the evidence confirms the same.
- (b) The FBI did not alter the FLIR video. The FLIR tape recorded by the FBI Nightstalker aircraft from 10:42 a.m. to 12:16 p.m. on April 19, 1993, does not contain audio. Attorneys for the Davidians and their families claimed that the FBI removed the audio in the weeks following the fire in order to hide radio communications among the FBI commanders. This

allegation took on greater credibility with the discovery of undated handwritten notes that the Office of Special Counsel removed from the office of an FBI attorney. The notes read in part: "the originals had audio on them but when copies were made by FBI HQ, the audio portion was removed."

To investigate this allegation, the Office of Special Counsel had an accomplished audio and video alteration experts conduct detailed examinations of the original FLIR tape. The experts determined that the FLIR tape was recorded in a depth modulated form, meaning that the audio and video signals were intermixed during recording. In this mode of recording, it is not possible to delete the audio from the video tape without also deleting the original video. The experts concluded that, although the entire FLIR tape for the period 10:42 a.m. to 12:16 p.m. contains no audio (and video is off for five minutes and 41 seconds of the tape), no one altered the FLIR tape. Instead, the experts believe it is probable that the crew of the Nightstalker simply failed to activate the audio. This conclusion is buttressed by an audio transmission from the preceding flight of the Nightstalker which indicates that the operator turned off the audio recorder at the conclusion of that flight.

The Office of Special Counsel believes this expert analysis completely resolves the issue and concludes there was no alteration of the late morning FLIR. The Office of Special Counsel has included an expert report concerning this issue as Appendices G and H attached hereto.

(c) The FBI commanders did not mislead Congress about their reasons for ordering the CEV to breach the gymnasium area of the complex in order to facilitate the

introduction of tear gas. The Office of Special Counsel investigated whether the FBI on-scene commander Jeffrey Jamar and HRT commander Rogers were truthful when they testified before Congress that they ordered CEV-3 to breach the gymnasium to clear a path to the base of the tower of the complex for tear gas insertion. Jamar also testified that he wanted to create escape routes for the Davidians. Members of Congress and others have charged that the destruction of the gymnasium was an effort to harm the Davidians or to dismantle the building prematurely.

Rogers and Jamar provided the Office of Special Counsel the same explanation they had provided to Congress. Their statements were fully supported by all of the other agents involved in this aspect of the April 19 operation. These agents confirmed that: (1) earlier in the day, Rogers and Jamar had expressed a desire to create escape routes for the Davidians; (2) Rogers instructed CEV-3 to breach the gymnasium in order to make a path that would permit the insertion of tear gas into the tower; and (3) Jamar and Rogers never indicated an intent to dismantle the complex or to harm the Davidians. Further support for the credibility of the agents' statements is that one of the two HRT agents in CEV-3 had told FBI investigators about Rogers' instructions to make a path to the base of the tower only 24 hours after the fire at Waco– long before the propriety of their activities at the gymnasium came into question.

In addition to the statements of the agents, one of the logs kept on April 19 has a specific entry at 10:57 a.m. which fully supports the statements that CEV-3 was attempting to create a path to the base of the tower for tear gas insertion. It states: "HRT-1 directs delivery to base of the tower- Black." "HRT-1" refers to HRT commander Rogers. "Black" refers to the back side of the complex, where the gymnasium was located.

The FLIR video which recorded almost the entire activity of CEV-3 at the gymnasium also provides very significant evidence. While the video clearly shows the collapse of the gymnasium, it also supports the agents' statements that they were attempting to create a path to the tower. CEV-3 made its first penetration of the gymnasium at 11:18 a.m. Between 11:18 a.m. and 11:27 a.m., CEV-3 made nine successive penetrations into the gymnasium. Each penetration was into the same opening and towards the tower. After the ninth penetration, when the gymnasium roof began to collapse, the driver of CEV-3 continued to attempt to penetrate the gymnasium, still aimed toward the tower. ⁷⁴ If the intent had been to dismantle the gymnasium, there were both safer and quicker means to accomplish that result. In fact, HRT had a CEV with a blade specifically equipped to dismantle the structure if the HRT so desired.

The Office of Special Counsel is also aware of a document dated June 24, 1993, entitled "Recommendation for the Shield of Bravery for the Hostage Rescue Team," which states:

At mid-morning, [the agents in CEV-3] were given the mission of slowly and methodically beginning the dismantling of the large facility to the rear of the compound commonly called the "gymnasium." Utilizing their CEV in a very deliberate and surgical manner, they began dismantling the gymnasium.

The Recommendation was submitted by Jamar and Rogers, although the investigation was unable to determine who actually drafted the document. While the document contradicts the testimony of Jamar and Rogers that the penetration of the gymnasium was for the insertion of tear gas and the creation of escape routes, on March 3, 1994, Jamar resubmitted a revised Recommendation in which the above-quoted language was deleted.

⁷⁴Eventually, CEV-3 did begin to penetrate the gymnasium in a direction not aimed at the tower. However, the evidence indicates this was done because of concern of a possible threat of a Davidian reported to be in the upper floor of the gymnasium.

The Office of Special Counsel is confident the quoted language is simply incorrect. The FLIR video does not show a "deliberate and surgical . . . dismantling of the gymnasium," and the agents in CEV-3 were fully credible in stating that they were not given the mission to dismantle the gymnasium. Rather, the evidence indicates Jamar and Rogers wanted the Davidians to exit the complex peacefully, and they testified truthfully as to their intent in ordering CEV-3 to breach the gymnasium.

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After interviewing 1,001 witnesses, reviewing in excess of 2.3 million pages of documents, examining thousands of pounds of physical evidence, studying thousands of photographs, listening to hundreds of hours of audiotapes, viewing hundreds of hours of videotapes, and conducting numerous expert analyses and tests, the Office of Special Counsel concludes with certainty that the government did not start the fire on April 19, that the government did not fire gunshots on April 19, and that the government did not misuse its armed forces during the Waco incident. Rather, the Davidians caused the tragic loss of life on April 19. The Office of Special Counsel has further concluded that the government did use three pyrotechnic tear gas rounds on April 19. The use of these rounds did not start the fire, nor did it otherwise cause harm to the Davidians.

With respect to the government's handling of inquiries and litigation that followed April 19, 1993, the Office of Special Counsel has concluded that incorrect statements concerning the use of pyrotechnic tear gas made by Attorney General Reno and FBI Director Sessions, were due to lack of knowledge rather than to any deliberate effort to mislead the public or anyone else. However, a few government employees did knowingly conceal the FBI's use of pyrotechnic tear

gas rounds at the concrete construction pit on April 19, 1993, from Congress, the courts, and the public, and are responsible for the widespread but erroneous belief that the government caused the deaths of the Davidians.

III. Investigative Methods

This Section of the Report describes the investigative methods employed by the Office of Special Counsel to ensure the reliability of the conclusions discussed above.

Prior to the appointment of the Special Counsel, the executive, legislative, and judicial branches of government had already conducted factual inquiries concerning the events at Waco. The Office of Special Counsel studied the 1993 "Report to the Deputy Attorney General on the Events at Waco, Texas February 28 to April 19, 1993" (the "Scruggs Report"); the 1993 "Fire Investigation Report;" the 1993 "Lessons of Waco: Proposed Changes in Law Enforcement" (the "Heymann Report"); the 1993 "Evaluation of the Handling of the Branch Davidian Stand-Off in Waco, Texas by the United States Department of Justice and the Federal Bureau of Investigation" (the "Dennis Report"); the 1993 "Report of the Department of the Treasury on the Bureau of Alcohol, Tobacco and Firearms Investigation of Vernon Howell also known as David Koresh" (the "Treasury Report"); the 1999 Report by the General Accounting Office to the Secretary of Defense, Attorney General and Secretary of the Treasury entitled "Military Assistance Provided at Branch Davidian Incident" (the "GAO Report"); transcripts of the congressional hearings of 1993 and 1995; the 1996 Report on the "Investigation into the Activities of Federal Law Enforcement Agencies Toward the Branch Davidians" issued by the United States House of Representatives, Committee on Government Reform and Oversight and Committee on the Judiciary (the "House Report"); transcripts of the criminal trial of the Davidians in 1994; and filings and testimony in the civil suit brought by the Davidians and their families against the United States. While the Office of Special Counsel did not rely upon the findings of these

inquiries, it adopted a methodology that thoroughly tested the relevant conclusions that they reached.

1. Staffing. The Office of Special Counsel employed 74 people at its peak of its operations, including 16 attorneys, 38 investigators, and 21 support personnel. In hiring attorneys, the Special Counsel sought a balance of experience: prosecutorial, criminal defense, large case management, and writing experience. The supervisory attorneys included Deputy Special Counsel, Edward L. Dowd, Jr., who resigned as the United States Attorney for the Eastern District of Missouri to serve as Senator Danforth's deputy. The remaining attorneys included one criminal defense lawyer, three present and one former Assistant United States Attorneys, two former judge advocates of the United States Air Force, two civil attorneys and one former Department of Justice trial attorney.

The United States Postal Inspection Service ("USPIS") provided most of the investigators. The Office of Special Counsel did not hire agents from the FBI, ATF or any other agency implicated in the investigation. A core of 15 USPIS inspectors assisted in all aspects of investigative operations, and 20 inspectors performed document and evidence review and coding. The USPIS provided its inspectors without seeking reimbursement from the Department of Justice

⁷⁵Other supervisory attorneys included Chief of Staff Thomas A. Schweich, a civil litigator at Bryan Cave LLP and writer with experience in large case management; Director of Investigative Operations, James G. Martin, an Assistant United States Attorney specializing in public corruption cases; and Stuart A. Levey, chief of the Washington Office, who came from the criminal defense firm Miller, Cassidy, Larroca & Lewin LLP. Thomas E. Wack, a civil litigator at Bryan Cave LLP and member of the American College of Trial Lawyers, served as General Counsel. The Office also retained legal scholar Geoffrey Hazard as an ethics consultant.

⁷⁶Concurrently, Mr. Dowd became a partner at the St. Louis office of the law firm Bryan Cave LLP.

for their salaries.⁷⁷ Most inspectors had at least 10 years of investigative experience, many at a supervisory level. The Office of Special Counsel also hired one retired USPIS Deputy Chief Inspector, a retired special agent of the Internal Revenue Service, and the resident agent in charge of the U. S. Drug Enforcement Administration office in St. Louis.

Support personnel included secretaries, legal assistants, a receptionist, two administrative officers, and three interns. The Office of Special Counsel also hired contractors to assist in matters relating to information technology.

Each employee who did not have an active government security clearance went through a background check conducted by the Office of Federal Investigations, ⁷⁸ and certain employees designated by the Office of Special Counsel obtained security clearances at the top secret level and special Department of Defense briefings required for access to a specific category of national defense information. Senator Danforth required each employee and expert to sign a statement in which the employee or expert promised complete impartiality and agreed not to communicate publicly on issues concerning the investigation.

2. Offices. At the outset of the investigation, Senator Danforth determined that he would headquarter the investigation in St. Louis, Missouri, since the witnesses were dispersed across the country. Senator Danforth also believed that he could better conduct an impartial, unimpeded investigation if it were headquartered outside of Washington, D.C. However, in the interests of economy and efficiency, Senator Danforth opened a smaller Washington office that

⁷⁷The agents were under the supervision of the Director of Investigative Operations and Assistant Inspector In Charge Robert Stewart and Inspector In Charge Rick Bowdren.

⁷⁸Because the FBI was a subject of the investigation of the Office of Special Counsel, the Office did not permit the FBI to conduct the background checks.

interfaced directly with the various federal agencies involved in the investigation and handled matters concerning many witnesses who live in the Washington, D.C. area.

The Office of Special Counsel also staffed a small office in Waco, Texas, so that investigators would have more direct access to the voluminous evidence stored at or near the courthouse. The Waco office generally housed two or three investigators who focused on reviewing the physical evidence and obtaining information from the Texas Rangers.

- 3. Document Acquisition and Control. In order to organize the large volume of documentary evidence, the Office of Special Counsel assigned one lawyer, 20 agents, and a paralegal to work on document acquisition, control, and review.
- (a) <u>ACQUISITION</u>. The Office of Special Counsel established a highly structured system for the acquisition of documentary evidence. The Office has obtained over 2.3 million pages of documents, 27,400 photographs, 440 video tapes, 1900 audio tapes, 250 computer diskettes, and 13 computer hard drives. The Office requested documents from the Department of Justice, the FBI, the Central Intelligence Agency ("CIA"), the United States Attorney's Office for the Western District of Texas, ATF, the Department of Defense (including several thousands of pages of classified materials), the Smithsonian Institution, the White House, counsel representing the Davidians and their families in the civil litigation, and several additional sources.

The Office of Special Counsel asked the government entities to produce all documents and other materials related in any way to the Waco matter. The Office of Special Counsel also reviewed the records compiled by the Texas Rangers, which the Rangers had delivered to the custody of the United States District Court for the Western District of Texas,

Waco Division.⁷⁹ Initially, the federal agencies provided the Office of Special Counsel with the same documents that the agencies had provided to the Court in the civil litigation, but this production lacked some relevant documents, including privileged, law enforcement sensitive, post-September 1999, and computer-stored documents, among others. The Office of Special Counsel encountered substantial resistance from some federal agencies to the production of some of these records.

The Department of Justice, for example, resisted the production of notes and records of its attorneys that post-dated the appointment of Senator Danforth, even though it acknowledged that it had no right to withhold privileged communications from the Office of Special Counsel (because the Office is technically part of the Department of Justice).

Furthermore, the Office of Special Counsel and Department of Justice had numerous disagreements over the production of computer files, hard drives, and e-mail. In addition, the Office of Special Counsel repeatedly received assurances from the Department of Justice that the Department of Justice had produced all hard copy documents, yet witnesses told the Office that certain categories of documents had not been turned over to the Office. Similarly, individual witnesses arrived at interviews with notes, videos, and diaries that the Department of Justice had never asked them to provide to the Office of Special Counsel.

Ultimately the parties resolved evidence production issues to the satisfaction of the Office of Special Counsel. However, the Office expended an unnecessarily large amount of time and resources negotiating these issues in light of the Attorney General's initial offer of total

⁷⁹On August 9, 1999, Judge Walter S. Smith, Jr. ordered that all federal agencies and the Texas Rangers deliver their Waco-related documents and evidence to the federal courthouse at Waco.

openness and independence for Senator Danforth. On several occasions, Deputy Attorney
General Eric Holder had to intervene to secure the cooperation of certain Department of Justice
officials. While the FBI was generally cooperative with the document requests made by the
Office of Special Counsel, on several occasions during the investigation the FBI discovered
Waco-related information that had not previously been provided to the Office of Special Counsel,
despite FBI Director Louis Freeh's clear instruction to conduct an exhaustive search. In addition,
on one occasion, the Office of Special Counsel received information that led the Office to believe
that there may have been omissions in the FBI's production of documents. The Office of Special
Counsel (with the consent and approval of Director Freeh) therefore took the unprecedented step
of sending eleven agents and three attorneys to search files within the FBI's Office of General
Counsel, and obtained important records in the process.

Similarly, ATF initially resisted the production of records that ATF had promised its agents would be kept confidential. The parties agreed that the Office of Special Counsel would review those documents at ATF and copy only those relevant to the investigation. Ultimately the cooperation of ATF was commendable.

The Office of Special Counsel also obtained commendable cooperation in obtaining documents from the United States Attorney for the Eastern District of Texas, the Department of Defense, and the counsel for the Davidians and their families.

⁸⁰Because she is a material witness, the Attorney General recused herself from interface with the Office of Special Counsel, so she bears no personal responsibility for the difficulty in obtaining records.

(b) <u>DOCUMENT CONTROL</u>. Investigators for the Office of Special Counsel put documents obtained from any source, except for classified Department of Defense documents⁸¹ and some documents from the FBI Office of General Counsel, into a computerized database system established and run by Washington, D.C. based Litigation Systems Inc. ("LSI"). LSI, which has developed and utilized digital litigation support technology since 1984, had previously worked on numerous complex civil cases as well as several federal projects, including a major case for the Antitrust Division of the Department of Justice. Ultimately, LSI assisted the Office of Special Counsel in converting 2.3 million pages of documents into an easily accessible electronic form. Cleared LSI personnel performed the initial document coding, entering such fields as author and date. The Office of Special Counsel utilized 20 experienced postal inspectors to review and comment on documents received. 82 Each lawyer and investigator received mandatory training on how to search for documents, by using specific text, words, and fields within documents. This activity proved valuable in locating a significant number of key documents that previous investigators and parties had not uncovered and that would probably not have come to light were it not for the efforts of the United States Postal Inspection Service document review team and the sophisticated technology provided by LSI.

⁸¹The Office of Special Counsel handled classified Department of Defense information in accordance with Department of Defense security and storage requirements. The findings of this report are in no way limited by the inability of the Office of Special Counsel to disclose certain classified aspects of the Department of Defense's activity at Waco. All such information is immaterial to the questions contained in the Attorney General's Order.

⁸²This effort was led by Assistant Special Counsel John J. Sardar and Postal Inspector Frank L. Graham.

4. Physical Evidence Review. The Office of Special Counsel conducted an exhaustive review of the physical evidence that the Texas Rangers gathered from the complex after the fire. The evidence is located in two places. First, the physical evidence that the Rangers believed might be used in legal proceedings is currently in 214 numbered boxes in the basement of the federal building in Waco. Investigators from the Office of Special Counsel examined and photographed all of this evidence. They then provided a log of the evidence to each Office of Special Counsel attorney and investigator for review.

Second, several thousand pounds of shells, fire debris, concrete, etc., which the Department of Justice criminal prosecution team did not believe would be used in legal proceedings, are in 12 large CONEX containers stored two miles from the courthouse at Waco. Several investigators with the Office of Special Counsel, working with the Rangers, went through these containers and found additional physical evidence relevant to the investigation.

5. Witness Interviews and Reports. The Office of Special Counsel interviewed 1,001 witnesses, including present and former employees of the Department of Justice, the FBI, the Department of Defense, ATF, the CIA, the Texas Rangers, the Texas Department of Public Safety, the Alabama and Texas National Guards, the Smithsonian Institution, the Tarrant County Medical Examiners Office, Davidians, fire and FLIR experts, pathologists, experts on the religious practices and beliefs of the Davidians, and interested third parties. The Office conducted follow-up interviews of 129 witnesses. In addition, the Office of Special Counsel reviewed statements made by these witnesses in interviews, depositions, testimony, and Congressional hearings.

During the first two weeks of the investigation, the Office of Special Counsel secured agreements with the Department of Justice, the Court, the congressional committees investigating the Waco matter, and counsel for the Davidians that any party interviewing any witness would afford the Office of Special Counsel 10 days prior notice so that the Office could interview the witness first.⁸³ The Office wanted to interview witnesses before they were prepared for testimony before Congress or in the civil litigation discovery process.

The Office of Special Counsel's Director of Investigative Operations then determined the order of the interviews. When an interview was scheduled, the responsible attorney or agent posted information about the interview on a central board at the office, so that the entire team could provide information to the interviewers that would assist in the interview process. Upon completion of the interview, the agent or lawyer assigned to each interview prepared a detailed memorandum of interview. The interviewers gave brief reports of interviews at staff meetings and distributed the memoranda of interviews to attorneys and agents. The document team then placed the completed memoranda of interviews on a searchable database.

On request, the Office of Special Counsel reviewed with several witnesses copies of their memoranda of interview, and allowed the witnesses to make suggestions or corrections. The Office of Special Counsel permitted other witnesses to go over the notes of the interview with the agent at the end of the interview to ensure that the notes accurately recounted the witness

⁸³Senator Arlen Specter, heading a subcommittee of the United States Senate Committee on the Judiciary, agreed in a letter only to hold off on interviews for thirty days after the beginning of the investigation, but in practice generally provided advance notice of any interview that his staff intended to conduct. The parties to the civil litigation did not actually execute a stipulation requiring 10 days notice until March 2000, but agreed to this process from the outset and adhered to it prior to the execution of the stipulation.

statements. None of the witnesses made any material changes to the notes or memoranda reviewed by them.

6. Expert Analysis, Field Tests, and Reports. The Office of Special Counsel retained experts in the fields of arson, fire spread analysis, toxicology, chemical engineering, atmospheric gas dispersion, explosives, ballistics, tool mark examination, audio and video enhancement and authentication, forensic phonetics, forensic pathology, air traffic operations, FLIR systems, and FLIR imagery interpretation. The Office of Special Counsel experts reviewed the prior work of other experts and performed independent analyses of physical, audio, video and photographic evidence. The work and findings of these independent experts have been critical to the Office of Special Counsel's investigation. Copies of their reports are attached hereto as Appendix D through Appendix N. The USPIS administered the retention and payment of experts to prevent the Department of Justice from obtaining insight into the activities of the experts. The USPIS also provided polygraph and forensic document examination (which included both handwriting and indented writing analysis) expertise, forensic photography, computer forensic assistance and video reformatting and reproduction assistance.

Experts provided opinions on the following issues:

(a) <u>FIRE</u>. The Office of Special Counsel instructed its fire experts to determine: (A) whether CS or methylene chloride gas caused or contributed to the spread of the fire; (B) the effect of ventilation on the tear gas concentration levels inside the complex; (C) the points of origin and cause of the fire; (D) how fast and in what manner the fire spread; (E) whether having firefighting

⁸⁴These experts worked under the direct supervision of Bradley J. Swenson, Assistant Special Counsel–Experts and Consultants.

equipment on the scene would have saved additional lives; and (F) the cause of the explosion observed at 12:26 p.m. on April 19. Copies of their reports are attached hereto as Appendices D, E and F.

- (b) <u>TOXICOLOGY</u>. The Office of Special Counsel tasked its two toxicological experts to determine whether CS or methylene chloride gas killed, incapacitated or disoriented any Davidians to the point that they were unable to exit the complex. Copies of their reports are attached hereto as Appendices K and L.
- (c) <u>WEAPONS/BOMB</u>. The Office of Special Counsel ballistics and tool mark experts determined: (A) whether shells collected from FBI sniper positions indicated that the FBI fired shots on April 19, and (B) whether fuel cans collected from the debris contained manmade tool strike holes. Explosives experts from Northern Ireland and the United States also analyzed debris and other evidence to respond to allegations that a shaped charge exploded at the complex on April 19. Copies of their reports are attached hereto as Appendices M and N.
- (d) <u>PATHOLOGY</u>. A forensic pathologist with special expertise in sudden death due to gunshots, explosion, and fire reviewed the original autopsy files and independently attempted to determine the cause of death for each Davidian who died on April 19. For each Davidian who died of a gunshot wound, the pathologist determined the likely type of ammunition used (high versus low velocity) and, if possible, the distance from which the weapon was discharged. A copy of his report is attached hereto as Appendix J.
- (e) *FLIR*. As stated earlier, the Office of Special Counsel retained two organizations with FLIR expertise to analyze the 1993 FLIR data. Vector Data Systems (U.K.), Ltd. performed an analysis of the 1993 "flashes" on the FLIR tape and worked jointly with the

Office of Special Counsel and the United States District Court for the Western District of Texas to develop the protocol for and to execute the FLIR test at Ft. Hood. The second expert utilized advanced enhancement techniques, computer algorithms and three-dimensional reflection geometry analysis to determine whether the flashes on the 1993 FLIR tape were associated with any human movement or government gunfire. In connection with the execution of the FLIR test, the Office of Special Counsel also retained an air operations expert who controlled the activity of the helicopter and fixed-wing aircraft during the test at Ft. Hood. Copies of their reports are attached hereto as Appendices H and I.

(f) <u>AUDIO/VIDEO</u>. The Office of Special Counsel retained three experts to analyze audio and video tapes including the Title III tapes from April 16 to 19, 1993, and the FLIR tapes from April 19, 1993. These experts reviewed the relevant tapes for alteration, erasure, and authenticity. They also transcribed audio tapes. Copies of their reports are attached hereto as Appendices G and H.

7. Civil Proceedings. At the time that Attorney General Reno appointed Senator Danforth and several times thereafter, senior representatives of the Department of Justice recommended that the Office of Special Counsel seek a stay of the civil proceedings brought by the Davidians and their families against the government pending the outcome of the Office of Special Counsel investigation. The Office of Special Counsel rejected this recommendation because: (1) Senator Danforth did not want to delay or deprive the Davidians of their day in court; and (2) the legal precedent for such a stay was weak since the investigation was not initially criminal in nature.

⁸⁵The FLIR test would not have been possible without the direct assistance of Secretary of Defense William S. Cohen and his staff, and the assistance of the Right Honorable Geoffrey Hoon MP, Secretary of State for Defence of the United Kingdom.

The Office of Special Counsel developed early a constructive relationship with the Court that ultimately allowed for such activities as the court-supervised FLIR test and an effective system for the production, maintenance, and storage of evidence. The parties to the civil litigation agreed that the Office of Special Counsel could have *ex parte* communications with the Court. ⁸⁶ Cooperation between the Court and the Office of Special Counsel has proven beneficial to the truth-seeking process.

8. Interaction with Congress. The Office of Special Counsel maintained communications with representatives of both the majority and the minority members of the congressional committees that have been conducting investigations of the Waco incident concurrently with the investigation by the Office of Special Counsel.⁸⁷ The Office of Special Counsel did not disclose specific investigative facts to the congressional committees, but it did coordinate the interviews of certain witnesses with the congressional committees. At the request of the Department of Defense, the Office of Special Counsel also allowed the disclosure to Congress of the results of the polygraph test of a former U. S. Army Special Forces soldier who was acting as an observer at Waco on April 19, 1993. In addition, the Office of Special Counsel permitted

⁸⁶After the Office of Special Counsel proposed the joint FLIR test with the Court against the wishes of the Department of Justice, some Department of Justice officials made efforts to have the Department of Justice order the Office of Special Counsel to cease communicating with the Court. The Office of Special Counsel made it clear to the Department of Justice that it would not cease such communications. The Deputy Attorney General agreed with the Office of Special Counsel that the office could continue *ex parte* communications with the Court.

⁸⁷These committees were the United States Senate Committee on the Judiciary chaired by Senator Orrin Hatch, Senator Patrick Leahy, Ranking Minority Member and its special subcommittee headed by Senator Arlen Specter; and the Committee on Government Oversight and Reform of the House of Representatives of the United States chaired by Representative Dan Burton, Representative Henry Waxman, Ranking Minority Member.

several congressional staff members to observe both the FLIR test at Ft. Hood on March 19, 2000, and the review of evidence in the CONEX containers at Waco in November of 1999. The Office of Special Counsel cooperated fully with an audit of its financial controls by the General Accounting Office, the auditing arm of Congress, in April 2000.

9. Interaction with the Department of Justice and FBI. As Senator Danforth was the first person appointed under the new Department of Justice Special Counsel Regulations, 28 CFR § 600 et seq., the Office of Special Counsel interacted frequently with the Department of Justice to resolve issues concerning the division of administrative responsibility between the Office of Special Counsel and the Department of Justice. The Office of Special Counsel and the Department of Justice also had frequent contact concerning the Department of Justice's compliance with investigative requests made by the Office of Special Counsel during the course of the investigation.

These discussions were often contentious. Employees of the Department of Justice took the position that the Department of Justice could maintain a certain degree of control over the conduct of the investigation, which the Office of Special Counsel considered improper since the Department of Justice was a subject of the investigation. For example, the Department of Justice: (1) attempted to deny the Office of Special Counsel access to internal documents postdating the appointment of Senator Danforth and resisted the production of important e-mail as being too burdensome; (2) claimed to control the power to waive the Department of Justice's attorney-client privilege; and (3) demanded that the Department of Justice be consulted before the Office of Special Counsel took any actions (such as proposing the FLIR test) that might affect the results of the civil litigation. The Office of Special Counsel did not allow these problems to affect the

However, the Office of Special Counsel strongly recommends that the Department of Justice draft more specific guidelines outlining the relationship between a Special Counsel and the Department of Justice in situations where the Department of Justice is the subject of the investigation, and that the Department of Justice recognize the need for the investigative independence of the Office of

The Office of Special Counsel also interacted on a regular basis with the FBI. The successful completion of the Office's investigation of the FBI depended on the commendable efforts of Supervisory Special Agent Patrick Kiernan, who was designated by the FBI to serve as the liaison to the Office of Special Counsel. Agent Kiernan, who is a lawyer and an ethics instructor at the FBI Academy, ensured that the Office of Special Counsel received the requested information from the FBI and greatly facilitated the Office's access to many FBI witnesses.

IV. Statement of Facts

Special Counsel in such situations.⁸⁸

The following Statement of Facts contains the essential background information needed to understand the conclusions of the Special Counsel's Report on the five issues contained in Order 2256-99 of the Attorney General. It does not attempt to chronicle fully the Waco incident.

⁸⁸The need for more specific guidelines is underscored by the fact that the Office of Special Counsel had numerous problems with the Department of Justice which often required the personal intervention of the Deputy Attorney General and the Director of the FBI to resolve.

A. ATF Commences its Investigation of the Branch Davidians.

- 1. In May 1992, the McLennan County Texas Sheriff's Department provided information to the Bureau of Alcohol, Tobacco and Firearms ("ATF") that Vernon Howell, also known as David Koresh ("Koresh"), leader of the Branch Davidians religious group at Mt. Carmel (the "Davidians"), had received large shipments of firearms, inert grenades, and black powder at a small structure known as the Mag Bag, located approximately six miles from the main Davidian living quarters outside of Waco, Texas. Investigation by ATF revealed deliveries by United Parcel Service ("UPS") of suspicious firearms components and possible explosive precursor materials. Further investigation revealed that upon arrival at the Mag Bag, the UPS driver would be met by a Davidian and escorted to the Mt. Carmel complex. At the complex, the Davidian would make payment, often in cash.
- 2. Working in consultation with the United States Attorney's Office for the Western District of Texas, Waco Division, ATF began a federal investigation of the Davidians. Over the next several months, ATF agents developed additional information which corroborated their suspicion that the Davidians had produced, and continued to manufacture, illegal weapons and explosives. ATF derived this information from interviews with former Davidians, discussions with a confidential informant, records of UPS shipments to the complex, and reports of experts who had studied the contents of shipments of explosive materials received by the Davidians.
- 3. In addition to the specific evidence of illegal gun manufacturing, ATF learned that Koresh and his followers harbored strong anti-government views, that he expected confrontation

with the federal government, and that he and his followers viewed such confrontation as a means to religious salvation. More detailed information on these beliefs is included in Appendix A attached hereto. This information heightened ATF concerns that Koresh had violent intentions that posed a danger to the public.

- 4. Following a series of internal ATF meetings in December 1992, ATF began an undercover operation intended to develop additional evidence that the Davidians had violated federal firearms laws. ATF rented a house approximately 325 yards from the Davidian complex and, on January 11, 1993, began surveillance operations. In addition, ATF agents posed as students and made contact with Davidians who worked in and around Waco. In particular, ATF undercover Special Agent Robert Rodriguez made direct contact with Koresh in late January 1993 and continued to visit the complex up to and including February 28, 1993. Koresh conveyed to Agent Rodriguez his disdain for federal gun control laws and ATF in particular. As a result of the information developed during the course of the investigation, ATF concluded that there existed probable cause to believe that the Davidians had violated and continued to violate federal firearms laws. At that point, ATF began preparations for a search of the complex and the arrest of Koresh.
 - B. ATF Seeks the Support of the Armed Forces of the United States and Claims a Drug Nexus to Its Investigation.
- 5. In late November or early December 1992, ATF determined that it might be able to supplement its understanding of the Davidian complex by conducting aerial reconnaissance. On December 4, 1992, a representative from the Department of Defense told ATF that it could obtain aerial reconnaissance from the armed forces, but that ATF would have to reimburse the armed

forces for the costs of the support that the armed forces provided unless the investigation had a "drug nexus." At that time, ATF informed the Department of Defense representative that there was no drug connection with its investigation.

- 6. On December 11, 1992, a representative of ATF visited the office of the Texas National Guard counterdrug support program to solicit National Guard support. A National Guard representative also told ATF that the counterdrug support program would only support ATF if ATF established a drug nexus to its investigation. Nevertheless, on December 14, 1992, ATF wrote a letter to the Texas National Guard counterdrug support program requesting "the use of aerial reconnaissance of the target site in the form of aerial photography," but did not mention the existence of a drug nexus.
- 7. In mid-December 1992, Special Agent David Aguilera, the ATF case agent for the investigation of the Davidians, began to solicit information from his sources about the possible use of illegal drugs at the complex. A former Davidian reported to ATF that there had been an illegal methamphetamine lab at the Davidian complex when Koresh took over the complex in 1988. ATF reported that some Davidians had histories of drug use, trafficking, and arrests, and that the Davidians had received shipments of chemicals that they could possibly use to manufacture methamphetamine. An ATF agent later reported that Koresh had stated that the complex would be a good site for a methamphetamine lab.

- 8. Believing that it had developed an adequate "drug nexus" to avail itself of the National Guard's counterdrug program, ATF sent a second request for support to the Texas National Guard dated December 18, 1992. This letter explicitly referenced possible narcotics at the complex. From this point forward, all ATF requests for assistance to the National Guard and the active duty military of the United States in connection with the initial investigation of the Davidians made some reference to the possible use or manufacture of illegal drugs at the complex.
- 9. The Texas National Guard agreed to support the investigation. On January 6, 1993, it flew an aerial surveillance mission over the Davidian complex using a UC-26 fixed wing aircraft equipped with a thermal imaging system. An informal analysis of the thermal imaging data done by a Guard airman who was not a qualified infrared image interpreter revealed a "hot spot" which he thought to be consistent with the existence of a methamphetamine laboratory at the complex. The Alabama National Guard, working at the request of the Texas National Guard, flew a follow-up mission over the complex on January 14. The Texas National Guard then resumed its surveillance flights, flying missions over the complex on February 3, 6, 18 and 25. The Guard aircraft provided video and photographic reconnaissance to ATF which assisted ATF in planning future operations.
- 10. As the National Guard provided its surveillance support, ATF stepped up its efforts to obtain support from the active duty armed forces of the United States for a planned search of the complex and arrest of Koresh. On January 21, Department of Defense's liaison to ATF drafted a letter for the signature of ATF's Chief of Special Operations to the Army Regional Logistics

Support Office ("RLSO") in El Paso, Texas. The letter requested (a) the use of the Military Operations in Urban Terrain ("MOUT") facility at Ft. Hood, (b) the loan of seven Bradley Fighting Vehicles ("Bradleys") to ATF, and (c) driver training and on-call maintenance support for the Bradleys. The letter referred explicitly to the "continuation of the firearms and drug case" and contained an attachment listing an extensive amount of equipment that it wanted on an on-call basis. The Army RLSO orally informed ATF that it could not meet a request of such magnitude.

- 11. Despite the initial rejection of its request, ATF continued to solicit military support. On February 2, ATF briefed representatives of Operation Alliance, the Joint Task Force Six ("JTF-6"), and the commander of the Rapid Support Unit ("RSU") on the status of the investigation.

 Operation Alliance is a coalition of law enforcement and military organizations which coordinates counterdrug support in the Southwest Border Region, including the State of Texas. JTF-6 serves primarily as a "clearing house," linking law enforcement agencies with military units for counterdrug missions. In early 1993, the RSU was comprised of a Special Forces company of Third Special Forces Group from Ft. Bragg, North Carolina, and its function was to carry out the counterdrug missions delegated by JTF-6.
- 12. On February 2, after the briefing, an ATF coordinator at Operation Alliance prepared requests for military support of the planned operation which were sent to JTF-6 and the Texas National Guard. These letters were signed by a border patrol agent who served as the Operation Alliance Director of Resource Management, and sought assistance in "planning, training, equipping and command and control in serving a federal search warrant . . . to a dangerous

extremist organization believed to be producing methamphetamine." These letters also stated "special assistance is needed in medical evacuation contingency planning and on site trauma medical support." ATF dropped its earlier request for the Bradleys.

- 13. On or about February 3, the commander of the RSU, Major Mark Petree, began to question the propriety of fulfilling ATF's request for military support. Specifically, he expressed concerns about ATF's request for training which included assistance in planning ATF's service of a federal search warrant and providing RSU medics on site during the execution of the warrants. He relayed his concerns to a Special Forces civilian employee who in turn contacted Major Philip Lindley, a military lawyer for the U.S. Army Special Forces Command at Ft. Bragg, North Carolina. Maj. Lindley concurred with Maj. Petree, believing that ATF's request for assistance exceeded the level of active duty military participation in civilian law enforcement activities permitted by applicable federal statutes, case law, military regulations and policy. Maj. Lindley believed that the requested assistance as proposed "crossed the line" and exposed the active duty military members of the RSU carrying out this request to both civil and criminal penalties.
- 14. Maj. Lindley drafted a memorandum on February 3, 1993, which reflected his thought processes as events unfolded. In that memorandum, he stated his position on the ATF request as follows: "[a]t the point where the RSU assisted in the actual planning and rehearsal of the take down, participation in the arrest was 'active'." Therefore, it was not permissible under the *Posse Comitatus* Act. Maj. Lindley also expressed his concerns about the on-scene medical support requested by ATF. He believed that by treating injured Davidians, Special Forces medics would be

in danger of "direct participation in the search and arrest of the civilians." Finally, Maj. Lindley also discussed in his memorandum the training capabilities of the RSU, stating that providing close quarters battle training was beyond the expertise of the unit. Based on these facts, Maj. Lindley concluded that ATF's request "appeared to go beyond DoD guidance for these missions," and he "advised against the operation" as initially planned.

15. Later on February 3, following discussions with Maj. Petree, Maj. Lindley received a call from Lt. Col. Ross Rayburn, legal advisor to JTF-6, who vigorously disputed Maj. Lindley's assessment that the proposed RSU mission was improper, and accused Maj. Lindley of trying to "undercut" the counterdrug mission of JTF-6. Lt. Col. Rayburn also issued a legal opinion that ATF's requested assistance was legal, in part because ATF had not requested RSU to accompany ATF to the complex to effectuate the search. Lt. Col. Rayburn wrote, "[t]here is no legal objection to providing ATF with instruction and training during the rehearsal phase of the operation." Furthermore, Lt. Col. Rayburn stated "there is no legal prohibition" on providing medical care support. After further discussions with counsel at the Army Special Operations Command and the United States Special Operations Command, Lt. Col. Rayburn yielded and the military components involved reached a consensus that the RSU would not provide the assistance as initially requested.

16. During the following weeks, relevant military authorities worked on an "execution order" detailing the support that the RSU would provide, and they had the order reviewed by a military lawyer for possible violations of the law, including the *Posse Comitatus* Act. The execution order dated February 17, 1993, directed that the "RSU will not provide mission specific

advice . . . RSU teams will not accompany BATF teams on either the operation nor [sic] any site visit within the area of operation," and "RSU personnel will not become involved in search, seizure, arrest or similar law enforcement related activities." Subsequently, the commander of JTF-6, Brig. Gen. John Pickler, issued the order to the RSU, and members from one of the RSU's six detachments, ODA 381, arrived at Ft. Hood on February 22 prepared to provide ATF the support authorized in the order. Over the next few days, members of ODA 381 and ATF officials met to identify the necessities for the ATF's training and rehearsals.

17. Between February 24 and 26, ODA 381 constructed a portable door entry and reuseable window on a practice facility, helped ATF tape off an area that represented the Davidian complex, provided medical evacuation and radio communications training, and coordinated the use of the ranges at Ft. Hood. On February 26 and 27, ATF conducted rehearsals at Ft. Hood. ODA 381 provided safety advice and acted as human "silhouettes" during ATF's room clearing exercises. As ordered, the ODA 381 let ATF define the parameters of its operation although one member of ODA 381 provided limited advice in an area of his expertise. Most of ODA 381's members left Ft. Hood on the evening of February 27. Four ODA 381 members remained at Ft. Hood until February 28 to assist in cleaning up the training site. Due to a flat tire and a severe thunderstorm, these four ODA 381 members were delayed in their return and arrived back at

⁸⁹As stated earlier, a weapons sergeant for ODA 381 stated he provided ATF general advice within his expertise in mounting and dismounting vehicles in a tactical manner, but he did not give specific advice to the ATF in mounting and dismounting the cattle trailers used in the February 28 raid.

McGregor Range, Ft. Bliss, Texas, on March 1. No ODA 381 members accompanied ATF to the Davidian complex on February 28.

18. Also in February 1993, ATF obtained permission from the Texas National Guard to utilize Guard helicopters and crews in connection with the planned search and arrest at the Davidian complex. In the last week of February, three members of the Texas National Guard, the commander of the Austin Army Aviation Facility, the State Aviation Officer, and one of the pilots who flew the mission on February 28, learned that ATF planned to use the Guard's helicopters as a diversion for ATF's raid. One person, the commander of the Austin Army Aviation Facility, expressed safety concerns to the State Aviation Officer about the plan. Nonetheless, the plan to use the Guard helicopters as a diversion did not change. On February 27, the Guard helicopters participated in ATF's rehearsals, and the remaining pilots and crew of the Guard helicopters learned for the first time that they would act as a diversion during the ATF raid the next day.

C. ATF Attempts to Execute Search and Arrest Warrants.

19. On February 25, ATF Agent Aguilera presented to a federal magistrate an affidavit in support of an application for warrants to arrest Koresh and to search the Davidian complex and the surrounding 77 acres. The affidavit had been reviewed by Assistant United States Attorney William Johnston. The affidavit alleged violations of 26 U.S.C. § 5845(f)— unlawful possession of a destructive device. The affidavit also contained a discussion of alleged child abuse. There was no mention of alleged drug activity at the complex. The federal magistrate issued the warrants that same day.

- 20. According to ATF, on February 28, while ATF prepared for the dynamic entry into the complex, Agent Rodriguez entered the complex and spoke to Koresh. While there, he learned that Koresh had heard about the planned execution of a warrant and that the operation had been compromised. Indeed, local media had also learned of the planned search and arrest and had preceded ATF to the complex to cover the entry. Rodriguez reported to his supervisors that Koresh knew about ATF's operation. ATF supervisors nonetheless decided to execute the warrant on February 28.
- 21. Members of ATF's warrant execution team departed a preset staging area at 9:20 a.m. on February 28 in cattle trailers. They arrived at the complex, entered the driveway, exited their vehicles, and approached the complex. According to Davidians Kathryn Schroeder, Victorine Hollingsworth and Marjorie Thomas, several Davidian males, including Koresh, were armed and prepared to fire on ATF agents. While there is some dispute as to who shot first—a matter outside the scope of the Attorney General's Order to the Special Counsel—there is no dispute that the Davidians were prepared for a gun battle and had ATF significantly outgunned.
- 22. A fierce and tragic gun battle ensued. Before a cease-fire could be arranged, the Davidians killed four and wounded 20 ATF agents. Additionally, ATF killed two and wounded five Davidians. At some point during or after the gun battle, the Davidians intentionally shot and killed three of their own at close range: Peter Hipsman, Perry Jones and Winston Blake. 90 All three

⁹⁰See "Forensic Pathology Evaluation of the 1993 Branch Davidian Deaths and Other Pertinent Issues," prepared for the Office of Special Counsel by its retained expert forensic pathologist, Michael A. Graham, M.D., at Appendix J.

Texas National Guard helicopters took fire and were forced to land, but personnel on board suffered no injuries. Witness interviews indicate that the Guard helicopters did not return fire.

- 23. At 9:48 a.m., Davidian Wayne Martin telephoned the Waco 911 emergency services and was put in contact with a deputy sheriff. Martin indicated that ATF agents were firing into the complex, but he soon hung up the phone. After Martin hung up, the deputy called the complex and yelled over an answering machine for someone to pick up the phone. The deputy eventually spoke to Martin but could not effectuate a cease-fire. At 10:35 a.m., undercover ATF agents provided an ATF Assistant Special Agent in Charge with the Davidians' phone number and, after an hour of negotiations with Koresh's second in command, Steven Schneider, the parties agreed upon a cease-fire.
- 24. Later that day, Davidian Michael Dean Schroeder and two others attempted to enter the complex. When ATF agents encountered them at the outer perimeter of the complex, Schroeder fired 18 shots at the agents. They returned fire and killed him. One of the others escaped, and the third was arrested. The death of Schroeder brought the total number of Davidians killed on February 28, 1993, to six.

D. ATF Transfers Control of the Standoff to the Department of Justice.

25. On March 1, after a series of meetings and teleconferences between senior officials of the Department of the Treasury (of which ATF is a component) and the Department of Justice (of which the FBI is a component), ATF turned control of the situation at the complex over to the

Department of Justice, and, more particularly, to the FBI. FBI Director Sessions then briefed President Clinton on the status of the standoff at Waco.

26. As of February 28, President Clinton had not formally appointed a new Attorney General. Stuart Gerson, a Bush Administration holdover, remained Acting Attorney General until Janet Reno was sworn in on March 12. Attorney General Reno had many people reporting to her on Waco-related matters. These included Associate Attorney General Webster Hubbell. Other reporting relationships were as follows. The Criminal Division at the Department of Justice normally reported to the Deputy Attorney General, but since there was no Deputy Attorney General in place during the entire Waco standoff, the Division reported directly to the Attorney General. John C. "Jack" Keeney was the Acting Assistant Attorney General who headed the Criminal Division. Under the Assistant Attorney General were several Deputy Assistant Attorneys General, including Mark Richard who supervised the activities of the Terrorism and Violent Crimes Section of the Criminal Division ("TVCS"). Section Chief James Reynolds and Deputy Chief Mary Incontro headed the TVCS. John Lancaster was a trial attorney in TVCS who later worked on the team that prosecuted some of the Davidians in 1994. The United States Attorney's Office for the Western District of Texas had primary responsibility for prosecuting federal crimes at Waco, including the shooting of the ATF agents. Ronald F. Ederer was the United States Attorney for the Western District of Texas, headquartered in San Antonio, Texas. Several Assistant United States Attorneys including First Assistant James DeAtley, William "Ray" Jahn, LeRoy Jahn, John Phinizy, and William "Bill" Johnston reported to Ederer. Johnston and Phinizy worked out of the Waco office.

- 27. Day-to-day law enforcement activity during the 51-day standoff was under the direct control of the FBI. FBI Director William Sessions reported to the Attorney General. Deputy Director Floyd Clarke and Associate Deputy Director W. Douglas Gow reported to Director Sessions. Assistant Director Larry Potts headed the FBI's Criminal Investigative Division, which reported to Clarke. Reporting to Potts was Deputy Assistant Director Danny Coulson, and Michael Kahoe, the Section Chief for the Violent Crimes and Major Offenders Section of the Criminal Investigative Division.
- 28. The FBI assigned the Special Agent in Charge of the FBI's San Antonio office, Jeff Jamar, as the on-scene commander at Waco and assigned numerous agents and FBI Special Weapons and Tactics ("SWAT") teams to work under his command. The FBI also assigned Special Agent in Charge Robert Ricks and Special Agent in Charge Richard Swenson to assist Jamar in supervising his team of agents. On February 28, 1993, Jamar dispatched Supervisory Special Agent Byron Sage, a trained negotiator, to Waco. The FBI later assigned Special Agent Gary Noesner to lead the negotiation team. Several weeks later, Special Agent Clinton Van Zandt replaced Noesner as head of the negotiation team. The FBI also later assigned a fourth Special Agent in Charge, Richard Schwein, to its Waco team.
- 29. In parallel with the establishment of the negotiation team, the FBI deployed its tactical team. On February 28, senior FBI officials notified Richard Rogers, commander of the FBI Hostage Rescue Team ("HRT") that he should deploy to Waco. Among the HRT members who reported to Rogers (and whose activities proved relevant to the charter of the Office of Special

Counsel) were Supervisory Special Agent Steve McGavin and Special Agent David Corderman.

The HRT also had sniper teams on site, one of which was led by Special Agent Lon Horiuchi.

- 30. The FBI personnel located themselves in three operations centers. In Washington, FBI leadership activated the Strategic Information Operations Center ("SIOC") where the FBI had its command and control resources. At Waco, the FBI on-scene commanders established the rear Tactical Operations Center ("TOC") located in a hangar at a former Air Force base on the campus of Texas State Technical College approximately five miles from the Davidian complex. The FBI on-scene leadership, negotiators, behavioral scientists, investigators, and agents monitoring the listening devices secretly inserted into the complex operated from the rear TOC. The FBI also established a forward TOC near the "Y" intersection, consisting of three mobile homes about 1000 yards from the front of the complex. This forward TOC served as the tactical operations center for the HRT and contained a communications center for equipment set up by the HRT, some with the assistance of the Army Special Forces.
- 31. The FBI designated areas of the complex by number and letter. It designated the front or south side of the complex as the white side, the back or north side of the complex as the black side, the right or east side of the complex as the red side, and the left or west side as the green side.⁹¹ The FBI referred to the first floor as "Alpha," the second was "Bravo," the third was

⁹¹The complex did not line up precisely on an east-west axis, but the Special Counsel uses these directional approximations for ease of reference.

"Charlie," and the fourth was "Delta." Window and door designations were identified by counting from left to right. See chart attached hereto as Exhibit 3.

32. The FBI HRT established sniper positions around the complex. The HRT Blue Sniper Team occupied Sierra-1 in the former ATF undercover house facing the white side of the complex. Upon their arrival at the Sierra-1 sniper position, members of the Blue Sniper Team observed spent shells in the undercover house. Sierra-1 Alpha was located in a house next door to Sierra-1 and housed assault team members and technical equipment. The HRT Gold Sniper Team occupied Sierra-2 in a structure on the green/black side of the complex. HRT also created Sierra-3, a sandbagged position on the red side which HRT snipers occupied on an as-needed basis. Prior to April 19, HRT assaulters also operated the Bradleys obtained from the National Guard from the sniper positions.

E. The FBI Obtains Additional Military Support.

33. Within hours after the gun battle between ATF and the Davidians on February 28, ATF and FBI made requests for extensive military support. Texas Governor Ann Richards saw the gun battle on television and immediately called the Commanding General of the United States Army's III Corps at Ft. Hood to ask if he knew anything about the operation. The General informed the Governor that III Corps had no assets at Waco and did not know any details of the operation, but he dispatched Brigadier General Peter J. Schoomaker, from the First Cavalry Division at

⁹² Sierra-4 was a campsite on the green side occupied by SWAT teams. It was located along the fence line beyond the inner perimeter of the complex.

Ft. Hood, to Austin, Texas, to advise the Governor and the Adjutant General concerning the requests for military support that they had received from ATF and the FBI. After meeting with Governor Richards, Gen. Schoomaker drove to Waco, arriving early on March 1. He met briefly with HRT commander Rogers, discussed the situation in general terms, and then returned to Ft. Hood. He did not provide any advice to the FBI at that time.

- 34. The Texas National Guard immediately dispatched 10 Bradleys to the scene with their crews and trained HRT members in their use. The National Guard later provided five CEV's, a tank retriever, as well as trucks, jeeps and supplies. All of this equipment was operated by the law enforcement personnel, not by National Guard personnel. The National Guard also provided maintenance support personnel and liaison personnel to handle any further equipment requests.
- 35. The FBI also made several requests for the loan of equipment and related training from the active duty military. Members of the active duty military trained HRT members in the operation of the equipment and provided maintenance support, but they did not operate the equipment. During the standoff, the U.S. Army provided two Abrams tanks (after disabling their offensive capability), three UH-1 helicopters, unmanned ground surveillance vehicles, trucks, communications equipment, ammunition, and various military supplies. Furthermore, the U.S. Army provided crews for vehicle and helicopter maintenance, medical staff, and liaison officers to handle additional equipment requests. The Army at III Corps obtained a legal opinion from an Army lawyer that providing military equipment to law enforcement agencies was permissible, but the Army deviated from standard procedures by failing to execute a lease agreement with the FBI

for the equipment until after the standoff. The FBI reimbursed the military for this support, and none of it was premised on the existence of a drug nexus.

36. The U.S. Army Special Forces also supported the FBI. Its members provided surveillance equipment in the form of remote observation cameras which transmitted television images from locations around the complex to the FBI forward TOC and a thermal imager located on a water tower several hundred yards from the red side of the complex. The Special Forces also provided ground sensing equipment to assist with the security of the perimeter of the complex. In order to train the FBI on the use of the equipment, observe its use, and maintain it, the Special Forces provided a total of 10 personnel during the entire standoff, although usually only three or four were present at any given time. On two occasions prior to April 19, Special Forces personnel went to forward positions (still hundreds of yards away from the complex) to repair or install the equipment. The Special Forces observers gathered information about the performance of the FBI and the performance of the Special Forces equipment. The Air Force provided television jamming equipment that government contractors operated briefly during the standoff. A member of the British Special Air Service ("SAS") was also present as an observer early in the standoff but had no active role in the FBI operation.

F. The FBI Attempts to Negotiate a Peaceful Resolution of the Standoff.

37. As the reports of other Waco investigations have set forth in detail, the FBI negotiation teams and the tactical teams ran different and sometimes conflicting operations. Most of this information is irrelevant to the charter of the Office of Special Counsel, but the following narrative

provides some context relevant to the Special Counsel's conclusions. The negotiators centered their activities in a Negotiations Operations Center at the rear TOC. The FBI negotiators worked with negotiators from ATF, the Texas Department of Public Safety, the Austin Police Department, and the McLennan County Sheriff's Department. Their principal objective was to secure the release of the children in the complex and eventually effectuate the peaceful arrest and departure of the adults. They worked in 12-hour shifts. Each shift utilized a primary negotiator and a secondary "coach" who maintained notes of the negotiations and provided prompts to assist the primary negotiator. FBI personnel recorded and, if possible, transcribed the contents of negotiation sessions. Each shift kept a negotiations log and handwritten chronology. The negotiators regularly prepared "situation reports" summarizing the status of negotiations. The negotiators also relied upon behavioral psychologists and religious experts for advice concerning the likely reaction of the Davidians to their negotiation strategy.

38. Over the 51 days, more than 40 law enforcement officers participated in negotiations, the objective of which was to get the Davidians to leave the complex peacefully. In order to effectuate a peaceful resolution to the standoff, Jamar made numerous concessions to Koresh based upon the recommendations of the negotiators. On February 28, the negotiators arranged the radio broadcast of a scripture message recorded by Koresh. Two days later, based on Koresh's promise to come out, they arranged for a 58-minute message from Koresh to be aired nationally on television and radio. The negotiators also allowed Davidians to exit the complex for such matters as the burying of Davidian Peter Gent, disposing of their dead dogs, and retrieving Bible study materials from one of their cars. The negotiators sent in medical supplies for the wounded, made

multiple deliveries of milk and food for the children, and provided the Davidians communications from family members outside the complex, as well as legal documents that Davidians had requested. Moreover, the negotiators took the unprecedented step of permitting criminal defense lawyers to enter the complex on several occasions to meet with Koresh and Schneider, even though the crime scene was unsecured.

- 39. The negotiators had some early success. Between February 28 and March 23, Koresh allowed 35 people to exit the complex. But Koresh also made repeated, well-chronicled and unfulfilled promises to exit the complex with the remaining Davidians, allowing only two people to exit after March 23. As early as March 3, a key behavioral psychologist, Dr. Park Dietz, advised the negotiators that Koresh would not leave the complex and would not allow anyone about whom he truly cared to leave, including his numerous biological children. FBI negotiators also obtained conflicting opinions on the likelihood of a mass suicide by the Davidians. The negotiators considered the possibility of a mass suicide either within the complex or as part of an assault against the FBI by exiting Davidians. On March 27, Schneider told negotiators that the FBI should set the building on fire. Eventually, after meetings with his attorney, Koresh promised that he would exit the complex after he had written an interpretation of the Seven Seals referenced in the Book of Revelation. The negotiators concluded that this was another empty promise because Koresh failed to turn over an interpretation of any of the Seven Seals.
- 40. The tactical group, led by the HRT, ensured the security of the perimeter of the complex and executed tactics designed to force the Davidians out of the complex. As the standoff wore on,

tactical actions—in which some negotiators concurred but others clearly did not—included cutting off the electricity, the unpredictable movement of vehicles, the use of flashbangs (loud, bright but non-lethal diversionary devices) to force Davidians venturing outside the complex without the intent to surrender to go back inside, and the use of disturbing sounds around the complex. The FBI logs and interviews indicate that the FBI utilized as few as seven and as many as 10 flashbangs near the complex during the standoff. Some negotiators believed that the activities of the tactical operators interfered with their efforts to get the Davidians to surrender peacefully. All tactical decisions were, however, approved by Special Agents in Charge, who received input from both the tactical group and the negotiators.

G. The FBI Develops a Tactical Solution to the Standoff.

- 41. As the release of Davidians slowed, and the prospects for the peaceful exit of the Davidians dimmed, the FBI stepped up efforts to develop a tactical resolution to the standoff. The FBI had developed the initial template for a tactical resolution at a time when the prospect for the voluntary surrender of Koresh was still high. The development of such plans during hostage situations was standard operating procedure for the FBI, and did not indicate an intent by the FBI to engage in a tactical resolution in the early stages of the standoff. The FBI would normally effectuate such a plan only in emergency situations such as suicide or murder within the complex.
- 42. In early March, HRT began the development of a tear gas insertion plan that the FBI could use to resolve the standoff even in a non-emergency situation. The "Proposed Operations Plan" dated March 10, 1993, provided that (a) CEV's would clear all obstacles from the white and

red sides; (b) CEV's would approach the front of the complex; (c) the FBI would demand the surrender of the Davidians; and (d) if necessary, personnel inside the Bradleys would shoot projectible flashbangs wherever needed and deliver CS gas into the complex. CEV's would create escape routes by punching holes into the building structure. In contrast to the final plan, which required the gradual insertion of tear gas, this plan called for the FBI to insert as much tear gas as necessary to secure the exit of the Davidians.

- 43. On March 14, after discussions within the FBI on the contents of the March 10 draft plan, the HRT issued a "Proposed Operations Plan Revision #2." The plan provided that CEV's would insert tear gas through canisters on booms on the vehicles, and made the first mention of the possible use of "ferret rounds"— non-pyrotechnic tear gas rounds fired from M-79 grenade launchers. Neither this revised plan nor the preceding one made any reference to the use of military or pyrotechnic tear gas rounds.
- 44. On March 16, at FBI headquarters in Washington, D.C., FBI Deputy Assistant Director Coulson sent an e-mail message to FBI Assistant Director Larry Potts addressing the tear gas insertion plan that the FBI leadership at Waco had developed and refined in the preceding days. The message discussed the possibility that the Davidians could engage in mass suicide or start a fire deliberately or by accident, but it concluded that personnel safety, among other factors precluded a firefighting response. The memorandum stated that the CEV's would make escape openings for the Davidians and then insert tear gas.

- 45. Despite concerns for the safety of firefighters, both Jamar and Sage contacted the Waco Fire Department, among others, to determine what fire response was possible. Waco Fire Chief Robert Mercer and Bellmead Fire Chief James Karl met with FBI agents several weeks prior to April 19 and were asked to prepare a plan to assist the FBI if needed. During this meeting, the fire chiefs used aerial maps to target water resources. Based on information provided by the departments, the FBI prepared a firefighting plan.
- 46. While the FBI negotiators tried to bring about a peaceful resolution to the standoff by providing telephonic suggestions to Koresh on how the Davidians could exit the complex and how the FBI would treat them thereafter, the negotiators began to lose hope that Koresh would ever leave voluntarily. An FBI memorandum dated March 22 prepared by the negotiation team indicated that the negotiators were willing to consider the tactical use of tear gas to end the standoff.
- 47. On March 23, following a request by HRT commander Rogers to implement the tear gas plan, Coulson wrote a memo critical of Rogers' request. He stated his opinion that HRT members at Waco were fatigued, noted the mistakes of the Ruby Ridge incident in which Rogers played a role, and advised Potts that both Potts and Kahoe should go to Waco to assess the situation for themselves.
- 48. On March 27, Jamar initialed "Proposed Operations Plan– Revision 3." This revised plan called for the removal of all obstacles, such as fences and vehicles, from the white side of the

complex the day before the tear gas insertion. The following day, the FBI would commence an all out insertion of tear gas into the complex. Two CEV's and four Bradleys would deliver tear gas into the complex without warning. The booms on the CEV's would penetrate the complex to deliver the tear gas and would also create exits for the Davidians. Attached to the plan were communications information and medical assignments, which involved the use of military personnel within the medical staging facility. The plan contained no reference to the use of flashbangs or pyrotechnic tear gas rounds.

- 49. Over the next several days, Coulson, Jamar and other FBI personnel debated the advisability of the tear gas insertion plan. Discussion centered around the concern that the Davidians might shoot at FBI agents immediately upon commencement of the operation. In Washington, D.C., Coulson expressed concern that the risk of Davidian gunfire was so high that the FBI should not implement the plan. At Waco, however, Jamar and others continued to advocate an all-out tear gas assault which differed substantially from the gradual insertion plan advocated by those in Washington.
- 50. On April 7-8, Clarke and Potts traveled to Waco in an effort to develop a consensus as to whether to recommend a tactical resolution to the standoff and, if so, what solution to recommend. After a series of meetings with Jamar, Rogers and others, they decided that a tactical resolution was appropriate and agreed on a plan that they would present for the review of Attorney General Reno on April 12.

51. On April 12, the FBI submitted to Attorney General Reno a "Briefing Book" which contained a revised operations plan as well as background information on the standoff and information from behavioral psychologists indicating that it was unlikely that Koresh would voluntarily surrender. Under this plan, from the outset the FBI would tell the Davidians (by telephone or loudspeaker) that it was inserting tear gas to force the Davidians out, that the FBI was not assaulting the complex, that the Davidians should not use their weapons, and that they must stay out of the tower area. Two CEV's would deliver tear gas into the complex in a gradual, but systematic fashion. If the CEV's took gunfire, the FBI would immediately accelerate the plan to an all out insertion of tear gas by using HRT personnel in Bradleys to shoot Ferret rounds into the complex. The CEV's would continue to insert tear gas with canisters mounted to their booms. The plan provided that the tear gassing would continue for 48 hours or until all Davidians had exited the complex. The FBI's standard deadly force policy, which allowed FBI agents to use deadly force only "in self-defense, the defense of another, or when they have reason to believe they or another are in danger of death or grievous bodily harm" would apply. If the Davidians had not exited after 48 hours, the FBI would use a CEV with a modified blade to peel back the walls and dismantle the complex.

H. The FBI Obtains Final Approval from Attorney General Reno to Implement the Tactical Plan.

52. On April 12, officials from the FBI met with officials from the Department of Justice to present the proposed tear gas insertion plan. Attorney General Reno participated in a second meeting at the FBI SIOC later in the day. Interviews regarding this meeting, along with contemporaneous notes, indicate that the FBI described the plan in detail. FBI officials presented

the plan as controlled and gradual, possibly lasting up to 48 hours. Attorney General Reno asked why the FBI had to act at that particular time. In response, the FBI emphasized that the Davidians were not coming out and the FBI had to increase the pressure on them. Participants at the meeting also discussed cutting off the water supply to the complex, but concluded that this tactic was not feasible. Attorney General Reno raised additional questions about the availability of gas masks, the effects of tear gas on Davidians, particularly on the children, and the availability of medical facilities. The FBI told her that there were probably no tear gas masks available for children, but that the tear gas would not cause them permanent harm. They discussed a plan to establish three detoxification units to help people who exited the complex, and told Attorney General Reno that pediatricians would be present during the tear gas operation. Other issues raised at the meeting included whether the plating on the tanks was sufficient to protect HRT personnel from .50 caliber weapons, what to do if the Davidians emerged from the complex shooting, what to do if they did not exit at all, and whether the plan should be delayed if Koresh's attorney requested more time. The meeting concluded without any resolution or decision by Attorney General Reno. During the next several days, Attorney General Reno and her staff sought additional information from numerous sources to supplement the responses provided to her by the FBI.

53. In accordance with the instructions of President Clinton that he be notified of changes in the FBI's strategy at Waco, Hubbell met with White House officials on April 13 to notify them of the proposed tear gassing plan. He informed White House officials that Attorney General Reno had not decided whether to implement the plan. White House Counsel Bernard Nussbaum briefed the President on the situation.

- 54. FBI Director Sessions convened a meeting on April 14 during which military experts addressed Attorney General Reno's questions and concerns regarding the tear gas plan. The FBI requested the presence of Gen. Schoomaker, a Special Forces colonel, and a toxicology expert employed by the Department of Defense. After Gen. Schoomaker's superiors approved the assignment, he drove to Waco where HRT commander Rogers gave him an aerial tour of the complex. They then landed at the forward TOC, and Rogers showed Gen. Schoomaker the communications center and the medical facilities. The two then flew to Ft. Bragg, picked up the Special Forces colonel, and continued to Washington, D.C. On the way to Washington, Rogers asked Gen. Schoomaker to review and comment on the tear gas insertion plan and Gen. Schoomaker told him that he could not do that.
- 55. During the April 14 meeting with Attorney General Reno and her staff, the toxicologist reported on the effects of CS gas, concluding that it posed no risk of permanent harm to the inhabitants of the complex. The discussion at this meeting is reflected in interview notes and in a memorandum prepared by the Special Forces colonel after the meeting. Attorney General Reno asked repeatedly about the dangers that tear gas posed to the children in the complex. The toxicology expert reassured her that the long-term danger to the children was minimal. The military personnel present noted, however, that the effects of CS gas were unpredictable, that the natural impulse would be to exit the building, but that people could behave irrationally when exposed to tear gas. When asked to comment on specific, tactical aspects of the plan, Gen. Schoomaker responded, "[W]e can't grade your paper." The military representatives did, however, note that a military operation would be quite different in that a military assault would be rapid,

violent, and would focus on killing the leaders. They further indicated that the military would insert the tear gas all at once.

56. The military experts also raised the possibility of a fire, noting that the British SAS had burned down a building during a tear gas operation in London. The FBI assured Attorney General Reno that the means of delivery of the tear gas would be non-pyrotechnic. According to Attorney General Reno, either at this meeting or later in the week, she gave an express directive that no pyrotechnic tear gas was to be fired "at the compound"—a phrase that was never clearly defined to include such areas as the concrete construction pit, the pool, and the underground bus located outside the main structure of the complex, but which Attorney General Reno meant to cover all of these areas.

57. Finally, the participants at the April 14 meeting discussed the issue of timing. Attorney General Reno asked again, "Why now?" The FBI told her that (a) there was no reason to believe that Koresh would come out voluntarily, (b) the health and safety of the children was in jeopardy, and (c) the effect of a prolonged standoff on the HRT was an issue. The Special Forces colonel also suggested that the HRT may need to stand down for retraining. Rogers opposed this suggestion. He told Attorney General Reno that the HRT had breaks during the siege, and was not fatigued or in need of retraining. He agreed, however, that if the siege continued for several more

⁹³Some people at the meeting do not remember hearing the word "pyrotechnic" but it was clear that the means of delivery to be used would not start a fire.

weeks, it might be necessary to pull the HRT back for retraining. At the end of the meeting, Attorney General Reno still had not decided whether to approve the plan.

58. Following further discussions among her staff, Attorney General Reno called Assistant United States Attorney Ray Jahn to inquire about conversations picked up by the Title III intercepts which indicated that the water supply at the complex might be running low. FBI agents again assessed the water supply issue, and concluded that the Davidians had plenty of water and had enough food to last a year. Attorney General Reno also directed Hubbell to contact negotiator Sage directly to obtain his assessment of the likelihood of a negotiated resolution. On April 15, Sage advised Hubbell that negotiations were at an impasse, and that a negotiated solution was unlikely in the short term. Sage told Hubbell that the only people who had left the complex were people whom Koresh wanted to leave.

59. On Friday, April 16, Attorney General Reno advised Hubbell that she had decided not to approve the plan at that time. This decision set off a series of meetings among Department of Justice and FBI personnel. Ultimately, Director Sessions appealed directly to Attorney General Reno, and requested that she reconsider her decision. After further considering the issue, Attorney General Reno changed her mind. She indicated that she was inclined to approve the plan, but wanted to see an even more detailed discussion of the plan and substantial supporting documentation setting out the conditions inside the complex, the status of negotiations, and the reasoning behind the plan. According to Attorney General Reno, she ultimately changed her mind because she was convinced that the Davidians would not come out voluntarily. She felt that the

FBI would eventually have to go forward with some plan, and that it was better to proceed when the FBI was ready and best able to control the situation.

60. Senior Department of Justice and FBI officials worked together to prepare the documentation requested by Attorney General Reno. The materials that they prepared included the written opinion of behavioral psychologist Dr. Park Dietz that negotiations were not likely to resolve the crisis and that Koresh would probably continue to abuse the children. FBI and Department of Justice officials met again on April 17 to review the plan, the supporting documentation, and the rules of engagement. Attorney General Reno approved the plan at approximately 7:00 p.m. Waco time (8:00 p.m. Washington time), and Jamar notified Rogers that the plan had been approved at 7:17 p.m. Attorney General Reno informed President Clinton of her decision to approve the plan on Sunday, April 18.

I. Activities Inside the Complex During the Days Preceding the Execution of the Tactical Plan.

61. As mentioned above, during the final days before the execution of the plan, Koresh told negotiators that he was writing an interpretation of the Seven Seals. Koresh sent a letter out on April 14 indicating that he would surrender when he finished writing his interpretation of the Seven Seals. Even as Koresh claimed he had finished interpreting the First Seal, Schneider acknowledged to FBI negotiators that he had not seen any work product. FBI behavioral scientists concluded that Koresh's letter constituted another empty promise and, accordingly, Attorney General Reno did not put credence in the letter. Koresh would not give any credible or consistent

timetable for surrendering, leading to a consensus among FBI officials that he had no intention of exiting the complex.

62. On April 16, the Davidians displayed a sign outside a window on the east or red side of the complex that said, "The flames await Isaiah 13." On April 17, Title III intercepts captured a conversation (unintelligible at the time) among Davidians concerning their plan to prevent fire trucks from reaching the complex: "You're definitely right . . . I think all the time he knows it . . . nobody comes in here;" ". . . bring the fire trucks and they couldn't even get near us;" "Exactly." As the FBI cleared the area in front of the complex of cars and other obstructions on April 18, the Title III intercepts picked up a conversation between Davidians in which Schneider said, "[Y]ou always wanted to be a charcoal briquette." The other responded, "I know that there's nothing like a good fire"

J. The FBI Initiates the Tactical Plan on April 19.

63. The events of April 19 are well-chronicled in numerous logs, timelines, audio, and video transmissions prepared contemporaneously, as well as numerous reports prepared after the fact. Throughout the standoff, including April 19, the agents kept a typed log of their observations of the activities at the command center in the rear TOC and a handwritten log at the forward TOC. The FBI negotiators kept logs, and the FBI leadership in Washington, D.C., kept a SIOC log. The following events are relevant to the Attorney General's Order to the Special Counsel.

⁹⁴See Footnote 11 at page 7.

- 64. Prior to April 19, the FBI had equipped each of two CEV's with tear gas canisters mounted on a boom extending from each CEV. CEV-1 had four refillable canisters of tear gas. CEV-2 had two refillable canisters of tear gas mounted so that its boom could reach the second floor of the complex. In addition, a CEV was equipped with a rail which could be used to remove the siding from a building. The FBI also equipped HRT agents in four Bradleys with M-79 grenade launchers to shoot non-pyrotechnic Ferret tear gas rounds. HRT Supervisory Special Agent McGavin commanded a tank retriever, designated the Staff Command Vehicle. McGavin and his team established a rally point for exiting Davidians southeast of the complex, and raised a large flag containing a red cross at that location. Two additional Bradleys occupied blocking positions, and two others were on standby to be used for medical evacuation. HRT commander Rogers occupied an Abrams tank.
- 65. The operations plan called for the use of Ferret tear gas cartridges, plastic projectiles that would burst on impact, dispersing their liquid tear gas load. The Charlie Team also had a supply of military M651 tear gas rounds, which utilized a burning process to disperse the tear gas. The operators' manual accompanying the military tear gas round describes its contents as a pyrotechnic gas mixture. Upon impact, this mixture ignites and burns at a temperature of approximately 500 to 700 degrees Fahrenheit. An M651 fired into a fuel rich environment, such as the Branch Davidian living quarters, had the capacity to ignite a fire. Because of the nature of the M651, the FBI had no plans to utilize them in the gas plan.

- 66. The Sniper Teams remained at Sierra-1 and Sierra-2 where they were joined by machine gunners from the HRT Golf and Echo teams. A medical evacuation Bradley moved to Sierra-2 shortly after the commencement of the operation. Three FBI snipers occupied Sierra-3. The seven SWAT teams provided perimeter security and medical response security. According to the medical annex to the FBI's operational plan, the plan was "designed to provide the best care possible for mass casualties which could potentially result from an explosion or other catastrophic event" at the Branch Davidian complex. Attorney General Reno had requested that medical support be available for every man, woman and child in the complex. In short, the plan called for a "transfer point" near the "T" intersection where casualties were to be evaluated and initially treated before being transferred to a "medical staging area" located at the entrance of the Forward TOC area located near the "Y" intersection. From there, the plan called for helicopters to be available to rush critical patients to one of a number of civilian medical facilities. The FBI effectuated this plan on April 19.
- 67. The CEV's approached the complex at 6:00 a.m. Sage telephoned into the complex, eventually reaching Schneider, and telling him that a tactical operation was about to begin, but that it was not an assault. At that point, Sage made an announcement through a public address system (an announcement that he repeated many times during the morning), stating that the FBI had begun to insert tear gas, that the FBI was not assaulting the complex, and that the Davidians should exit the complex and walk toward the flag with the red cross.

- 68. In accordance with the operations plan, CEV-1 punched its boom into the complex and discharged the first canister of tear gas into the first floor at a location designed to prevent the Davidians from moving to the underground bus at the green side of the complex. CEV-1 then continued its tear gassing operation systematically as outlined in the plan.
- 69. As the first tear gas insertion occurred, at 6:05 a.m., HRT Sniper Lon Horiuchi stationed at Sierra-1, saw what he believed to be green tracer rounds emanating from the complex toward the CEV. He radioed to the FBI commanders the word "compromise," meaning that the FBI was taking fire from the Davidians. Numerous FBI agents and other witnesses saw or heard gunfire coming from the complex, and some of these observations are recorded in the various FBI logs referenced above. Davidian gunfire continued sporadically throughout the morning. No logs or radio transmissions indicate that the FBI returned fire. At 6:17 a.m., the on-scene FBI leadership questioned the agents at various positions around the complex to learn whether they were returning fire. They all responded that they were not.
- 70. CEV-1 continued its insertion of tear gas, moving to the black side of the complex and eventually returning to a resupply area to refill its canisters. CEV-2 covered the red side, inserting tear gas until it too needed to refill its canisters. As a result of the calling of "compromise," the Bradleys began firing non-pyrotechnic Ferret rounds into the main living quarters of the complex almost immediately after the operation began. The first targets were the tower and windows from which Davidians were firing at the CEV's. Then the Bradleys began a more systematic process of attempting to fire Ferret rounds into all the windows at the complex.

71. By 6:27 a.m., the FBI had concluded the first round of the tear gassing operation, and Rogers announced that the FBI had tear gassed all windows in the complex. Due to the combination of high winds, the failure of some Ferret rounds to penetrate into the complex and/or discharge their tear gas, and the use of gas masks by some Davidians, the tear gas appeared to have little effect upon the inhabitants. No one exited. A Title III intercept recorded Davidians speaking without difficulty, indicating that they had suffered no seriously ill effects from the tear gassing operations at that time.

72. At 6:29 a.m., the FBI discovered that the CEV had accidentally cut telephone lines into the complex. At 6:41 a.m., the Davidians threw the phone outside the complex, probably because it had been disconnected when a CEV ran over the line. At 6:45 a.m., at the request of Rogers, Sage announced to the Davidians that, if they did not exit within two minutes, the FBI would resume tear gassing operations. When no one exited, Jamar and Rogers ordered a second round of tear gassing with Ferret rounds to begin. The FBI soon ran low on Ferret rounds and made efforts to locate additional rounds. The tear gassing continued throughout the morning, with planned breaks, and with repeated announcements by Sage that the Davidians should exit the complex. The FBI fired a total of 389 Ferret rounds into the complex during the entire April 19 operation; in addition, the FBI delivered 20 canisters of tear gas during the entire operation.

- K. The FBI Fires Three Pyrotechnic Tear Gas Rounds at the Concrete Construction Pit on the Green Side of the Complex.
- 73. Early in the morning, the Charlie Team Bradley unsuccessfully attempted to deliver Ferret rounds into the concrete construction pit on the green side of the complex. The Charlie Team made the attempt to prevent Davidians from hiding in the concrete construction pit which was connected to the main structure by a buried bus and an underground tunnel. At approximately 7:45 a.m., the Charlie Team Leader requested permission from McGavin to fire military tear gas rounds— which had better penetration capability— toward the concrete construction pit on the green side of the complex. Unlike a Ferret round, a military tear gas round delivers the tear gas through pyrotechnic means.

74. At 7:48:52 a.m., McGavin radioed Rogers and told him that he thought that the FBI could penetrate the concrete construction pit with a military tear gas round. Rogers gave permission to McGavin to fire military tear gas rounds although he suggested that they may not work due to water in the structure. Rogers has subsequently claimed that he believed that firing pyrotechnic tear gas at the concrete construction pit did not violate the instructions of Attorney General Reno because the concrete construction pit was not part of the flammable wooden living structure of the complex. The Bradley moved into position, and the driver dropped the back door. Special Agent Corderman used the back door of the vehicle as a platform from which to fire the military tear gas rounds. He fired three rounds at approximately 8:08 a.m. but immediately saw that they had bounced off the roof of the concrete construction pit. Two of the projectiles landed in a trench on the right rear portion outside of the construction pit near the tunnel entrance and at least of one of the rounds dispersed its gas, which created a tear gas cloud. This dispersal of gas was

recorded on videotape by news media on the scene and is visible in at least one aerial photograph taken during the day. The third projectile bounced off the roof of the construction pit and landed approximately 200 yards northwest of the water tower. The tear gas from this projectile drifted into Sierra-2 where HRT agents were located. All three rounds came to rest in no position capable of starting a fire in the complex. The firing of the military tear gas rounds was not recorded on any log on April 19. However, the radio transmission at 7:48:52 a.m. was recorded by the Nightstalker aircraft as follows:

HRT-2: HR-2 to HR-1

HRT-1: Go ahead, this is HR-1

HRT-2: Currently re-supplying Charlie-1 . . . there's relative safety er utilizing the vehicle for cover and attempt to get . . . penetrate the er construction project

HRT-1: You're talking about the black over top of the construction

HRT-2: Say again er HR-1

HRT-1: Are you saying he can penetrate the black covering over the construction on the green side

HRT-2: 10-4 . . . He thinks we can get into position and relative safety utilizing the track for cover and attempt to penetrate it with er military rounds

HRT-1: Roger. Of course, if there is, er, water underneath, it's just going to extinguish them, but you can try it

HRT-2: Yes 10-4 copy you can try it

HRT-1: Yeah, that's affirmative.

The FBI did not fire any other military tear gas rounds at Waco on April 19.

75. The three spent M118 shells from the firing of the three M651 projectiles were manually removed from the M79 grenade launcher used by Agent Corderman. The casings were presumably discarded on the floor of the Charlie Team's Bradley during the reloading of the grenade launcher. The grenade launcher could be used to fire both the pyrotechnic military rounds as well as the Ferret rounds. At some point on April 19, Charlie Team members cleaned out their Bradley in an area off the green side of the pit that became Sector E of the crime scene. The members discarded at least some of the shells from the Ferret and military rounds that accumulated on the floor of the vehicle during the tear gas operation.

L. The FBI Breaches the Complex.

76. At 9:01 a.m., Rogers radioed that he did not want the vehicles to insert tear gas into the front door of the complex because he wanted to create an escape route for the Davidians. At 9:12 a.m., a CEV pushed in the front door that the Davidians had blocked with a piano, after which, at 9:19 a.m., both Rogers and McGavin stated by radio to the vehicle drivers that the HRT should not insert tear gas into the front door so that the Davidians could avail themselves of the newly created exit route.

77. Between 9:30 a.m. and 10:00 a.m., Rogers, Jamar, and McGavin (and for some of the time Swenson) met at the "Y" intersection outside the complex to discuss the ineffectiveness of the

tear gas inserted thus far. They agreed that they would penetrate deeper into the complex in order to increase the effectiveness of their operation. While the plan only allowed for the systematic dismantling of the complex after the passage of 48 hours, the FBI on-scene leaders determined that they would need to penetrate the building to effectuate their tear gas delivery. Jamar and Rogers believed the occupants of the complex had taken shelter near the concrete bunker beneath the tower. Since the Bradley M-79 tear gas gunners could not otherwise reach this area, Rogers decided to order the breach of the building from the front and rear with the CEV's in order to deliver tear gas to this area.

78. After refilling the tear gas canisters the second time, CEV-2 lost its tread and its crew then occupied CEV-3, which was not equipped to deliver tear gas. CEV-3 drove to meet Rogers, who was in the Abrams tank, at which time Rogers instructed the crew to go to the black side of the complex and use the boom and blade to create a path to the tower. Rogers and the crew of CEV-3 have stated that the purpose of this operation was to create a driveway to the main tower so that CEV-1 could insert tear gas close to the tower.

79. The FBI Nightstalker surveillance aircraft captured the CEV penetration activity on its Forward Looking Infrared ("FLIR") thermal imaging system which had provided the audio recording of the radio transmissions concerning the authorization for the use of military tear gas rounds and the opening of an escape route through the front door. It also provided video of the front door being pushed in by the CEV. The video from the early morning FLIR was obscured by considerable cloud cover. By the time the operation to deliver tear gas to the tower began, the

cloud cover had lifted and the images were relatively clear. At 10:41 a.m., the beginning of the second shift, the operator failed to engage the audio, although the video remained operational.

80. At 11:18 a.m., CEV-3 made contact with the wall on the black side of the gymnasium. Its mission was to clear a path through the gymnasium (which the Davidians used as a storage area) to the tower, so that CEV-1 could then deliver tear gas. At 11:20 a.m., CEV-3 pushed through the wall of the gym, and then exited. At 11:21 a.m., the CEV entered again. The entries were slow and problematic because the driver feared a drop off or ledge, and encountered a large number of stored items that created obstacles. He also stated that he feared that Davidian snipers might be located in the catwalk at the top of the gymnasium. On the eighth entry, the CEV went completely inside the gym so that the front of the CEV (or the debris it was pushing) protruded from the front of the gym. At 11:27 a.m., the CEV clipped a beam, causing the gym roof to collapse.

81. The effort to reach the tower continued for over a half an hour longer, and included penetrations into the white side of the complex by CEV-1 as well, with portions of the structure continuing to collapse throughout the process. At about 11:30 a.m., the driver of CEV-1 penetrated the building on the white side perpendicular to the tower or concrete bunker area. Over the next twenty minutes, CEV-1 entered and backed out of the building three times. As the vehicle backed from the building, the operator used the blade to drag debris from the area. Again, the penetrations of the building were slow and methodical as the driver feared there may be a basement or drop off beneath the structure and the vehicle would become stranded. During this operation, the CEV-1 operator had swivelled the boom to the rear and, at 11:49 a.m., after repositioning the

boom, CEV-1 entered the structure once again to insert tear gas into the tower area. After inserting the tear gas, and on the command of Rogers, CEV-1 again penetrated this area and inserted a second canister of tear gas. At about 11:57 a.m., Jamar ordered the CEV to clear this area to allow the occupants to exit quickly and safely. CEV-1 then made several additional entries into the front door area. At 12:05 p.m., Rogers ordered the CEV to deliver tear gas to the white/red corner, and the CEV departed the area of the front door. Throughout this operation, the FBI FLIR tapes showed rapid "flashes" on and around the complex and the vehicles. These flashes were solar reflections off of certain types of debris, including glass, that was strewn around the complex.

M. The Davidians Prepare to Start the Fire.

- 82. During the early part of the execution of the FBI's tear gas insertion plan, the Title III intercepts recorded Davidians making references to getting gas masks; and they recorded the sounds of people loading guns, and moving to different parts of the complex. The Davidians commented on the "good" wind dispersing the tear gas, and opened windows to ventilate the complex further. The Title III intercepts also recorded sounds consistent with gunfire emanating from within the complex to positions outside the complex.
- 83. As early as 6:05 a.m., the Title III intercepts picked up conversation indicating that the Davidians were pouring fuel and preparing to light the complex on fire. The Title III monitors at the rear TOC were unable to understand these conversations, which remained largely unintelligible until they were professionally enhanced after the standoff. Because these conversations bear directly on the issue of who started the fire, some of them are included below. They indicate that

the Davidians began pouring fuel early in the morning on April 19, and that they prepared to start a fire at several different times during the tear gassing operation.

84. At 6:09 a.m., the intercepts recorded the following conversation among a group of Davidians:

Unidentified Male: Have you poured it yet?

Unidentified Male: Hm.

Unidentified Male: Did you pour it yet?

Unidentified Male: In the hallway . . . yes.

Unidentified Male: David said pour it right?

Unidentified Male: D'you need . . .

Unidentified Male: Come on let's go.

Unidentified Male: David said we have to get the fuel on.

Unidentified Male: Does he want it poured already?

Unidentified Male: We want the fuel.

Unidentified Male: Yeah.

Unidentified Male: We want some here.

85. At 6:15 a.m., the intercepts recorded this conversation:

Unidentified Male: Have you got the fuel . . . the fuel ready?

Unidentified Male: I already poured it.

Unidentified Male: It's already poured.

86. At 6:22 a.m., the intercepts recorded the following conversation among the Davidians:

Unidentified Male: Nobody comes in huh?

Unidentified Male: Nobody's supposed to come in.

Unidentified Male: Right.

Unidentified Male: They got some fuel around here.

Unidentified Male: Yeah . . . We've been pouring it.

Unidentified Male: Pouring it already.

Unidentified Male: We've got it poured already.

87. At 7:08 a.m., the intercepts recorded the following conversation among the Davidians:

Unidentified Male: That's good . . .

Unidentified Male: Real quickly you can order the fire yes.

Unidentified Male: Yeah.

88. At 7:20 a.m., the intercepts recorded the following conversation among the

Davidians:

Unidentified Male: You've got to put the fuel in there too.

Unidentified Male: Is it dry?

Unidentified Male: Hey let's put loads of fuel in here.

Unidentified Male: Fuel.

89. At 7:21 a.m., the intercepts recorded the following conversation among the

Davidians:

Unidentified Male: Is there a way to spread fuel here?

Unidentified Male: OK . . . what we do You don't know.

Unidentified Male: I know that won't spread . . . get some more.

Unidentified Male: So we only light it first when they come in with the

tank right . . . right as they're coming in?

Unidentified Male: Right.

Unidentified Male: That's secure We should get more hay in here.

Unidentified Male: I know.

90. At 7:23 a.m., the intercepts recorded the following conversation among the Davidians:

Unidentified Male: You have to spread it so get started OK?

Unidentified Male: Yeah . . . got some cans there.

Unidentified Male: Right here . . . two cans here . . . and that's . . . and the rest can take em . . .

91. At 11:27 a.m., the intercepts recorded the following conversation among the Davidians:

Unidentified Male: There isn't any reason to go out there.

Unidentified Male: No.

[Vehicle noise]

Unidentified Male: Do you think I could light this soon?

Unidentified Male: They're gonna go right through the middle here . . .

Unidentified Male: Whoa . . . whoa.

92. At 11:42 a.m., the intercepts recorded the following conversation among the Davidians:

Unidentified Male: We're near the point where we oughta be . . .

Unidentified Male: We've no . . . we're not to blame for that We're not to blame.

Unidentified Male: Looks to me that you gotta . . .

Unidentified Male: You'll have to deal with that.

Unidentified Male: Go and get the kids.

Unidentified Male: They'll go for the barn.

Unidentified Male: I want a fire on the front . . . you two can go . . .

- 93. Then, at 11:54 a.m., an unidentified male stated: "Keep that fire going . . . keep it."

 This was the last statement intercepted before the listening device ceased operating.
- 94. At approximately 12:06 p.m., an FBI agent observed a white male wearing a gas mask just inside of the front door area of the complex. The individual had a long rifle in his right hand and was walking from east to west holding something in his left hand. An overturned piano obstructed the FBI agent's view of the individual's hands and body, but the agent later concluded that the individual's movements were consistent with those of a person spreading fuel within the

complex. Also, the FBI agent observed the unidentified individual ignite a fire in the front door area of the complex. The agent reported his observation contemporaneously.

95. An FBI agent, who had a clear view into the chapel area, observed two individuals making movements which were consistent with the spreading of fuel. The FBI agent was located at a sniper/observer position approximately 180 yards from the southeast corner of the complex. The FBI agent was using binoculars and a spotting scope at the time of his observation. Seconds before smoke became visible on the second floor of the southeast tower, a SWAT agent observed a white male repeatedly bending over in the second floor room of the southeast tower where the fire ignited. The agent was located at a position on a hill approximately 900 meters from the east side of the complex, and was using field glasses at the time he made his observation. From within the complex, Davidian Graeme Craddock observed an unidentified individual pouring Coleman fuel in the chapel area of the complex. Craddock also overheard Pablo Cohen tell the unidentified person to pour the fuel outside rather than inside. A few minutes later, Craddock heard Mark Wendell say "light the fire," and, in response, Cohen stated "wait, wait, find out." At that time, Cohen and Wendell then had a conversation which Craddock could not overhear.

N. Fire Starts at the Complex and Nine Davidians Exit.

96. At 12:06 p.m., CEV-1 moved from the southeast corner of the complex toward the road. Moments later, at 12:07 p.m., the FLIR tape shows a visible fire signature in a second floor room at the southeast corner of the complex. The FLIR tape shows a second visible fire signature

in the dining room area at 12:08 p.m. The FLIR video shows a third visible fire signature in the stage area at the rear of the chapel.

97. As the fire began to spread, FBI agents heard gunfire within the complex. They stated that some of the rounds sounded "cooked off" by the heat, but that others were rhythmic in nature, leading some of the agents to conclude at the time that the Davidians were committing mass suicide.

98. Shortly after the fire began in the southeast corner of the complex, Davidians David Thibodeau, Derek Lovelock, Jamie Castillo, and Clive Doyle exited the chapel. Doyle had injuries on both sides of his hands consistent with liquid fuel burns. Graeme Craddock exited the chapel area through a window, entered the rear courtyard, and concealed himself in a concrete structure at the base of the water tower. He was not arrested until 3:30 p.m. At approximately 12:10 p.m., Davidian Renos Avraam exited to the roof. HRT agents attempted to help him to safety, although he resisted. Similarly, Davidian Ruth Riddle jumped from the white side roof but then reentered the complex. Special Agent James McGee exited his secure position in a Bradley, ran into the flaming building, and rescued Riddle against her will. Once Riddle was safely outside of the complex, McGee questioned her regarding the location of the children within the complex, but Riddle refused to answer. Marjorie Thomas and Misty Ferguson, who fell or jumped from the second floor on the white side of the complex, were badly burned. According to one of the Secret Service paramedics who treated her, Marjorie Thomas was in respiratory arrest and would have died had she not received the immediate medical care provided to her. During the course of the

fire, a total of nine Davidians exited the complex. These Davidians were initially treated in the fortified medical position near the "T" intersection and then, transported to the rear medical area field hospital. The severely burned victims were flown by MedEvac helicopter to Parkland Hospital in Dallas, Texas.

99. The FBI combined log reports the first observation of fire at 12:10 p.m. At 12:13 p.m., fire department assistance was requested. Within 18 minutes of the first observation of fire, the entire complex was engulfed in flames. Jamar permitted firefighting vehicles to approach the complex at 12:34 p.m. He has stated that he waited until then because of fear for the safety of the unarmed firefighters. Rounds continued to cook off inside the complex after the firefighting trucks were on the complex premises putting out the fire.

100. At 1:00 p.m., several HRT agents entered the concrete construction pit, waded through waist high water contaminated with sewage and rats, and reached the underground bus to search for survivors. Several FBI searchers, including HRT commander Rogers, entered the concrete construction pit with the hope that the children were hiding in the underground bus. They found none. They also could not open the trap door leading from the underground bus to the living quarters because it was covered with debris.

O. The FBI and the Texas Rangers Investigate the Crime Scene.

101. At approximately 4:00 p.m. on April 19, the FBI permitted the Texas Rangers to begin their efforts to secure the scene and gather evidence. The Rangers maintained security

around the remains of the complex. Captain David Byrnes was in charge of securing the scene pending the implementation of a search protocol. Although the Rangers had principal responsibility for organizing the search for evidence, numerous federal and state agencies and their components participated in gathering and analyzing evidence from this enormous crime scene. They included representatives from the FBI Laboratory, the Tarrant County Medical Examiner's Office, the Houston Fire Department's Arson Division, the United States Attorney's Office for the Western District of Texas, the Texas Department of Public Safety Crime Laboratory, the Texas Highway Patrol, ATF, and the Smithsonian Institution.

- 102. FBI agents from the FBI National Laboratory arrived at the crime scene in the evening of April 19. The FBI's firearms and tool marks section assumed the commanding roles for the FBI Lab on the scene. A member of the FBI's explosives ordnance section acted as the FBI's on-scene explosives expert. Although the Rangers were technically in control of the scene, many of these FBI agents had unfettered movement within the area throughout the crime scene investigation.
- 103. Items discovered by the crime scene team were to be treated in one of three possible ways. First, crime scene personnel could decide that the items had no evidentiary value and either leave them on the scene or throw them in the dumpster. Second, they could pick up items of possible evidentiary value and later determine them to have no evidentiary value, in which case they would be discarded without further inquiry. Thus, at various times during the search of the crime scene, searchers picked up items and threw them into roll-outs or movable dumpsters located

on the scene. Third, they could put items in bags and take them to the recovery location for numbering and logging into the evidentiary database.

104. The use of three M651 rounds on the morning of April 19, 1993, by FBI HRT members generated six pieces of potential evidence relating to the incident— three spent shells and three spent projectiles. Of these six articles of evidence, only one casing (Ranger No. 160) was ever logged into evidence. There are no reports of anyone ever seeing the two remaining shells. However, as detailed below, FBI crime scene searchers encountered all three projectiles, but none of these items was logged into evidence.

105. On April 20, 1993, during an initial walkthrough of the scene intended to locate and disarm any explosive devices, Wallace Higgins, the FBI explosives expert, found two M651 projectiles in the trench next to the concrete construction pit. Believing that one of the rounds still contained tear gas, he asked for and received permission from his supervisor, James Cadigan, to shoot at one of the projectiles to ensure that it was spent. Higgins claims he then borrowed a pistol from a Texas Ranger and shot at the projectile. Although Higgins recalled that he may have picked up a projectile and looked at it after he shot at it, he did not retrieve any of the projectiles for evidence collection. Rather, he left the projectiles in the trench. Additionally, neither the FBI nor the Texas Rangers prepared a report of Higgins discharging a firearm on the crime scene.

106. On April 22, the crime scene search personnel met at Ft. Fisher Texas Ranger

Museum to reach consensus on how to proceed with the evidence search. They decided to divide

the complex grounds into gridded sections so that people making use of the evidence in the future would know where each piece of evidence had been found. The grid contained 21 lettered sectors, from "A" to "W," excluding the letters "Q" and "K." Six teams, each lead by a Ranger, gathered and catalogued evidence. Photographers took pictures of key evidence before agents removed it. However, there were more sectors than photographers, so each photographer covered more than one sector. Although the outer most sectors were assigned letters A through F in a clockwise fashion, the designation of the inner sectors was done in a less organized manner, including some designations based on physical properties of the sector (for example, the pool sector was assigned letter P, the tower sector was assigned letter T, and the underground concrete construction pit sector was assigned letter U). This type of designation led to some confusion concerning the order of the searches and the boundaries of the sectors.

107. On April 23, 1993, during the search for evidence, Sergeant George Turner, a Texas Ranger, recovered an expended shell from a pyrotechnic tear gas round in Sector E, grid EC1. Sector E was located immediately adjacent to the left or green side of the concrete construction pit (Sector U). Sgt. Turner placed the M118 casing into a bag and logged it into the Rangers' evidence list as item 160. Sgt. Turner recalled that he attempted to identify it by asking FBI Supervisory Special Agent Richard Crum if he knew what the item was. Crum indicated that he did not know what it was but would try to determine its origin. This shell (later designated by the FBI as Q1237) is one of two component parts of a 40 millimeter pyrotechnic tear gas round referred to as a military round or XM651E1. It is part of the evidence stored in Waco. The other two shells were never located.

108. Texas Department of Public Safety ("DPS") lab employees recall that on or about April 28, 1993, they looked into (but did not formally search) the area of the trench beside the concrete construction pit. One technician said that she did not see the military tear gas projectiles that Higgins had previously seen there, and that she would not have missed them had they been there. The other technician said he went down into the trench and walked around, and that the projectiles were not there as of that date. Higgins also stated that he looked into the trench at the end of the crime scene search and did not see the projectiles.

109. The Rangers conducted a "line search" on April 30 involving 53 law enforcement officials who lined up fingertip to fingertip and searched the area outside the main structure of the complex. During this search, a member of the FBI special photographic unit and others found a third M651 military tear gas projectile approximately 200 yards northwest of the water tower. A Texas DPS photographer photographed the projectile, which had been flagged for recovery. The FBI agent summoned either Crum or Cadigan to the area to show him the projectile. This projectile was not inventoried as evidence, and extensive searches have never located the item. The photograph, however, is contained in the binders of photographs produced to the Branch Davidians' criminal defense team.

110. On May 3, 1993, a search team led by Rangers Johnny Waldrip and Fred Cummings began to search Sector U. As it appears on the sector map, Sector U included the underground area of the concrete construction pit, the ground level area between the construction pit and the water tower and the ground level area to the rear of the construction pit. However, the search team

understood the sector to include only the underground area. The crime scene search report refers to the sector as an area underground and includes a drawing of the sector which excludes the ground level portion of the sector. Further, none of the crime scene searchers remembers searching the ground level portion of this sector. The ground level portion of Sector U was not subdivided by grids as were many of the other sectors. Finally, there are no articles of evidence contained in the evidence database reported as having been collected from this portion of Sector U. This limited search of Sector U did not yield the two projectiles that Higgins had previously seen adjacent to the concrete construction pit.

- 111. On May 6, 1993, the crime scene team concluded its search for evidence. The search had encompassed 77 acres and included the complex residence and the concrete construction pit. After an exhaustive 17 day search of this unprecedented crime scene involving over 200 law enforcement personnel, the team had recovered thousands of pieces of evidence weighing thousands of pounds. The searchers recovered the burned corpses of at least 82 bodies inside the complex. The Rangers recovered at least 300 rifles and shotguns, including two .50 caliber BGM rifles, 34 AR-15 assault rifles, 61 M-16 assault rifles, 61 AK-47 rifles, and 5 M-15 rifles. Additionally, the Rangers recovered 60 pistols and thousands of pounds of live and spent ammunition.
- 112. On May 12, the Rangers loaded the evidence into a truck and drove it to Washington, D.C., delivering the evidence to the FBI Crime Laboratory on May 15, 1993. On May 17, the chain of custody was formally transferred to FBI Special Agent Cadigan. The FBI examined only a

portion of the evidence and returned most of the items to the Rangers. The FBI did not examine the shell identified as Ranger item 160 which was delivered in May, and returned it to the Rangers as one of numerous "items of non-probative value."

113. On April 19, 1993, at the direction of the Department of Justice, ATF had assembled an independent team of fire investigators. The team consisted of Assistant Chief Investigator Paul Gray, Houston Texas Fire Department; Senior Investigator William Cass, Los Angeles City California Fire Department; Investigator John Ricketts, San Francisco California Fire Department; and Deputy Fire Marshal Thomas W. Hitchings, Allegheny County Police Fire Marshal's Office. Also, Drs. James Quintiere and Frederick Mower were retained in order to conduct a fire development analysis.

114. The fire investigation team conducted a nine-day on-site investigation beginning April 21, 1993. Prior to gaining access to the crime scene, the fire investigation team viewed news media video recordings of the fire and discussed the possibility that fires had ignited in three separate areas almost simultaneously. On April 23, 1993, the fire investigation team began the process of collecting potential evidence and identifying items to be sent to the laboratory for analysis. The fire investigation team used an accelerant detection dog to determine which items were to be sent for laboratory analysis. The accelerant detection dog alerted agents to debris in the southeast corner area, the dining room area, and the chapel area, and to a number of articles of Davidian clothing.

115. The fire investigation resulted in the recovery of numerous Coleman fuel cans (some of which were intentionally punctured), lanterns, and numerous articles of debris on which the laboratory detected the presence of flammable liquids. The laboratory was able to confirm the accelerant detection dog's alerts on debris in the chapel area and in the southeast corner area of the complex.

116. The fire team concluded that: the "fire was caused by the intentional act(s) of a person or persons inside the compound;" the "fires were set in three separate areas of the complex;" and "flammable liquids were used to accelerate the spread and intensity of the fire."

P. The Medical Examiners Determine the Cause of Death of the Davidians.

117. On April 19, 1993, the Tarrant County Medical Examiner's Office, led by Dr. Nizam Peerwani, the Chief Medical Examiner, prepared to conduct the autopsies of the Davidians. The Tarrant County Medical Examiner's Office first became involved with the events at Waco when Dr. Marc Krouse, the Deputy Chief Medical examiner, was called on February 28, 1993, and told to prepare for the autopsies of the four ATF agents killed during the initial gun battle. In early March 1993, Dr. Krouse and Dr. Peerwani performed these autopsies, and Dr. Peerwani conducted another autopsy on the body of Michael Schroeder, who had been killed in a gun battle with ATF agents late in the day on February 28.

118. On April 19, Dr. Peerwani activated his office's Mass Disaster Plan. Dr. Peerwani's office received the first body from the crime scene on April 19. On April 21, Dr. Peerwani and an odontologist from his office surveyed the crime scene. Between April 22 and April 29, Dr. Peerwani's recovery team, including a photographer, criminalist, pathologist, and an anthropologist, assisted in the recovery of bodies. They developed a procedure for flagging, photographing, and removing the human remains from the scene. Later Dr. Peerwani created a diagram showing the location where they found each of the bodies.

119. Over the next month, Dr. Peerwani and his staff conducted autopsies at the Tarrant County Medical Examiner's Office. Dr. Peerwani led a team of professionals including pathologists, anthropologists, FBI fingerprint examiners, and odontologists from various organizations. Until they could be examined, the bodies were kept appropriately cool to preserve any evidence suggesting their cause of death. After their examination, the bodies were kept in a freezer donated by the FBI to the Tarrant County Medical Examiner's Office.⁹⁵

120. The autopsy reports indicate that on April 19, at least 20 Davidians were shot including at least five children under 14. Of the 20, 12 were shot in the head, two others were shot in the head and chest, three more were shot in the chest only, two were shot in the back and one, Schneider, was shot in the mouth. In several additional instances, the pathologists could not

⁹⁵Sometime after the examination, the freezer malfunctioned.

confirm, but would not rule out death by gunfire, which indicates that more Davidians may have been shot. Additionally, one child was stabbed to death.⁹⁶

Q. The Department of Justice and Congress Investigate the Activities at Waco.

121. Immediately following the fire, FBI Special Agent in Charge and spokesman Robert Ricks announced at a press conference that the FBI had not used any pyrotechnic devices during the April 19 operation. Within days, Congress convened hearings, and on April 28, 1993, Attorney General Reno testified that she had been assured prior to the operation that the tear gas and its "means of use" were non-pyrotechnic. HRT commander Rogers sat behind her during this statement but did not inform her that the FBI had used pyrotechnic tear gas at the concrete construction pit. In addition, FBI Director Sessions testified that the FBI had chosen CS gas because the agents could deliver it without pyrotechnics. Rogers, also present during the testimony of Sessions, failed to correct any potential misimpression left by this statement.

122. Numerous investigations and inquiries followed, including a fire investigation and scientific fire analysis, congressional hearings in 1993 and 1995, a 1993 Department of Treasury Report about the ATF's role in the Waco operation, and a 1999 GAO report on the use of the armed forces at Waco. Also, in 1993, the Department of Justice organized a series of inquiries into the Waco operation under the supervision of Deputy Attorney General Philip Heymann. This project was divided into four parts: (1) a factual review of the entire Department of Justice and FBI

⁹⁶<u>See</u> Appendix J for the Office of Special Counsel's expert's evaluation of the causes of the Branch Davidian deaths.

operation at Waco, (2) further review by a panel of experts who were asked to make recommendations based on the facts developed in the initial review, (3) a critical evaluation of the handling of the Branch Davidian standoff prepared by Edward S.G. Dennis, Jr., and (4) Deputy Attorney General Heymann's own report containing recommendations for changes to better handle similar situations in the future. None of these reports or investigations found evidence of criminal wrongdoing by the United States or its agents at Waco.

123. Attorney General Reno asked Richard Scruggs, an experienced federal prosecutor, to conduct the factual inquiry into the activities of the FBI and Department of Justice at Waco, including the April 19 operation. Scruggs was an acquaintance of Attorney General Reno's who came to Washington, D.C. from Miami at her request to assist her in her new role. Deputy Attorney General Heymann asked Assistant United States Attorney Steven Zipperstein and a Department of Justice Office of Professional Responsibility attorney, Robert Lyon, to work with Scruggs. The FBI's Inspections Division provided the investigative resources for the review. This effort was led by FBI Inspector Victor Gonzalez and Assistant Inspectors Herbert Cousins and Roderick Beverly. The FBI compiled memoranda of interviews and other documents. Scruggs and his team then drafted a summary of the beliefs of the Davidians and a narrative of the events occurring at Waco. Scruggs and his team did not conduct a formal investigation. They did not make efforts to determine or challenge the veracity of the statements of witnesses, nor did they test or challenge the FBI's widely publicized contention that it did not fire guns or use pyrotechnics during the standoff.

the fire. While the Scruggs team did not specifically ask witnesses whether they used pyrotechnic devices at Waco, one FBI pilot told Scruggs' investigators that he had heard a radio conversation about the use of "some sort of military round" at the concrete construction pit. The other pilot in that same plane told Scruggs' investigators that he observed a tear gas cloud form over the concrete construction pit. The investigators apparently attributed no significance to these statements.

Scruggs issued his report, entitled "Report to the Deputy Attorney General on the Events At Waco Texas February 28 to April 19, 1993," on October 8, 1993. In a section entitled "False Accusations that the FBI Started the Fire," the report stated that "a nationally recognized team of arson experts [concluded that] . . . the gas delivery systems that the FBI used were completely nonincendiary." Further, the Scruggs report stated that the arson team "noted that the tear gas delivery methods that had been selected evidenced the FBI's concern for eliminating fire hazards." The report, while discussing military involvement at Waco, did not analyze the legality of the use of the Armed Forces of the United States.

R. The Department of Justice Prosecutes the Davidians.

125. On August 6, 1993, a federal grand jury returned a ten-count superceding indictment charging twelve Davidians with various crimes arising out of their activities at the complex prior to February 28, during the 51-day standoff, and on April 19. The indictment named Kathryn Schroeder, Brad Branch, Kevin Whitecliff, Clive Doyle, Jaime Castillo, Livingstone Fagan, Paul Fatta, Woodrow Kendrick, Norman Allison, Graeme Craddock, Renos Avraam, and Ruth Riddle as defendants. The Davidians faced different charges, which included conspiracy to murder federal

agents, aiding and abetting the murder of federal agents, using and carrying a firearm during and in relation to a conspiracy to murder federal agents, aiding and abetting an attempted murder of federal agents, illegally carrying an explosive grenade, conspiring to possess and manufacture machine guns illegally, and aiding and abetting Koresh in the illegal possession of machine guns.

As part of the conspiracy count, the government alleged that the Davidian defendants had deliberately set fire to the complex on April 19. One Davidian, Kathy Schroeder, pled guilty to one count of armed resistance of a federal officer; the remainder prepared to go to trial.

126. Assistant United States Attorney Ray Jahn was the lead prosecutor on the case. His principal assistant on the case was his wife, Assistant United States Attorney LeRoy Jahn.

Assistant United States Attorneys Bill Johnston and John Phinizy assisted them, along with Department of Justice attorney John Lancaster and paralegal Reneau Longoria.

127. From August 23 to 25, 1993, the prosecution team met in Waco with several members of the Texas Rangers and FBI Crime Lab personnel to discuss the ongoing analyses of evidence. During the meetings, LeRoy Jahn asked FBI Special Agent Richard Crum to have the 40 millimeter shell analyzed to determine its nature. On August 25, Crum hand carried the casing to the FBI lab in Washington for analysis. Crum identified the casing as a "grenade launcher cartridge case." This casing, item 160, was labeled by the FBI lab as Exhibit Q1237. On December 6, 1993, a 49 page FBI lab report was issued identifying Q1237 (Item 160) as a "fired U.S. Military 40 MM casing which originally contained a CS gas round." The lab report made no mention of the pyrotechnic nature of the ordnance.

128. In November 1993, the government's criminal prosecution team made a trip to Quantico, Virginia, to interview members of the HRT who had participated in the events at Waco earlier that year. Before making the trip, the trial team viewed a recently released film produced by Linda Thompson entitled, *Waco: The Big Lie*. The film contained news footage showing an FBI agent shooting a grenade launcher from the back of a Bradley and, moments later, a cloud of tear gas rising from the area of the concrete construction pit. Thompson claimed in the film that this footage showed that the FBI started a fire in the concrete construction pit early on the morning of April 19. One reason for interviewing HRT members at Quantico was to hear their explanation of what was occurring in this footage.

129. The prosecutors showed the film to a large group of HRT members and then interviewed them in smaller groups. During the interview of the Charlie Team, Corderman told members of the trial team that the smoke shown in the film was not due to fire, but rather was a tear gas cloud from a military tear gas round that he had fired at the concrete construction pit. Corderman described the round as incendiary. Longoria misspelled the word "incendiary" in her notes next to the description of the military round. Both Lancaster and Johnston also have this information reflected in their notes which were recorded either during the Charlie team interviews or during a subsequent meeting of the prosecution team. Lancaster's notes state, "fired 1-4 incendiary rounds" and "1 military" round at the "ce-ment [sic] underground deal." Johnston's notes state, "Charlie—one green military (incind) smoke."

- 130. Members of the trial team also met with HRT commander Richard Rogers. LeRoy Jahn's notes reflect that Rogers told them that the FBI had used a "cupcake" round at the concrete construction pit, that he knew there was water in the concrete construction pit, and that the cupcake round had greater "penetrator" power than the Ferret rounds that had bounced off the plywood and tar paper covering of the concrete construction pit. Lancaster recalls that LeRoy Jahn asked Rogers what a cupcake round was and that Rogers explained that it was a military or pyrotechnic round. Longoria's notes from the same interview reflect that Rogers referred to the use of a "military tear gas round."
- 131. On its return to Waco, the criminal prosecution team prepared outlines and witness charts reflecting that the HRT had fired "military" rounds at the concrete construction pit during the early morning hours of April 19. These documents indicate that the trial team decided to save this information for rebuttal in the event that the Davidians attempted to claim that the "smoke" in the concrete construction pit was the result of an igniting fire, rather than the use of tear gas.
- 132. The government's trial team did not disclose the use of the military tear gas rounds to the lawyers for the Davidians under *Brady v. Maryland*, which requires prosecutors to provide the defense with exculpatory information. In the "Government's Response to Defendant Castillo's Specific Brady Requests," Ray Jahn stated, "[T]he government has no evidence that government agents fired gunshots on April 19, 1993, other than ferret tear gas rounds." However, the government provided the criminal defense team with a 49-page FBI lab report which referenced Q1237, the shell from a military tear gas round that the Rangers had located at the scene, and they

also provided the defense with numerous photographs, including the photograph of a spent military tear gas projectile taken by the crime scene photographer at the crime scene.

- 133. During the trial, the prosecution sought to prove that the Davidians started the fire.

 Dr. Quintiere, the government's fire expert, testified that the fire started in three or four locations simultaneously, and another expert testified that the Davidians had spread accelerants throughout the complex. None of the prosecutors mentioned the FBI's use of pyrotechnic rounds several hours before the fire started. They continued to view this evidence only as rebuttal evidence. They did provide testimony that the FBI had used Ferret rounds, and FBI HRT member Thomas Rowan testified accurately that a Ferret round was "not a pyrotechnic." The criminal prosecution team did not call as witnesses any members of the HRT members who knew about the firing of pyrotechnic tear gas rounds.
- 134. Ranger Turner recalled that on January 13, 1994, as he was preparing to testify in the Davidian criminal trial, FBI Special Agent Crum approached him and advised him that the shell that Turner had shown him earlier (labeled 160 and later Q1237) belonged to the FBI, that it was from an explosive military round, and that the FBI had the authority to use it to penetrate a door.
- 135. On February 26, 1994, the jury acquitted the defendants of the conspiracy and murder counts but convicted five defendants of the lesser included offense of manslaughter. Those convicted of manslaughter were Renos Avraam, Brad Branch, Livingstone Fagan, Jaime Castillo, and Kevin Whitecliff. Brad Branch, Kevin Whitecliff, Jaime Castillo, Livingstone Fagan, Graeme

Craddock, Renos Avraam, and Ruth Riddle were each convicted of using or carrying a firearm during a conspiracy to murder federal officers. Graeme Craddock was convicted of possessing an explosive grenade, and Paul Fatta was convicted of conspiring to illegally possess and manufacture machine guns and aiding and abetting the illegal possession of machine guns. Three Davidians, Clive Doyle, Woodrow Kendrick, and Norman Allison, were acquitted of all charges.

136. On June 17, 1994, the Honorable Walter S. Smith, Jr. sentenced Avraam, Branch, Castillo, Fagan, and Whitecliff to 40 years each in prison. Judge Smith sentenced Craddock to 20 years in prison, Fatta to 15 years, and Riddle to five years. Schroeder was sentenced to three years on July 8. The United States Court of Appeals for the Fifth Circuit affirmed the convictions on August 2, 1996. On June 5, 2000, the Supreme Court remanded the case to the District Court for resentencing, holding that the Davidians convicted of using or carrying firearms during and in relation to the ATF raid were improperly sentenced to 30 years for possession of machine guns because the jury had not found specifically that the defendants possessed machine guns. Judge Smith reduced from 30 years to five years the sentences imposed on Fagan, Whitecliff, Castillo, Avraam and Branch in 1994. Craddock's sentence was reduced by five years.

S. Congress Holds Additional Hearings in 1995.

137. In July and August 1995, the United States House of Representatives held additional hearings on the Waco incident. The hearings were convened jointly by the Judiciary Committee's Subcommittee on Crime and the Committee on Government Reform and Oversight's Subcommittee on National Security, International Affairs, and Criminal Justice.

138. Upon learning that Congress intended to hold the hearings in 1995, Attorney General Reno asked Scruggs and Zipperstein to lead the Department of Justice effort to prepare for these hearings. The lawyers in the Department of Justice preparing for these hearings viewed them as a highly partisan effort to impugn the actions of Attorney General Reno and her staff.

139. On June 8, 1995, Congress submitted document requests to the Department of Justice, which included a request for "all records of or concerning pyrotechnic devices and incendiary weaponry, including a listing of all pyrotechnic and incendiary devices . . . used on April 19 . . . against the residence of Koresh and the Branch Davidians," as well as a request for the names of persons who employed these devices. In response to an inquiry from the Department of Justice to the FBI concerning these requests, a member of the FBI's Office of Public and Congressional Affairs wrote to Scruggs that "[t]here were no incendiary or pyrotechnic devices used against the Branch Davidians on 4/19/93." Numerous other documents prepared by the FBI and the Department of Justice to brief Attorney General Reno for her testimony, including a set of "Waco Fact Sheets," indicated that the FBI did not fire pyrotechnic devices on April 19, 1993. Attorney General Reno was not asked about pyrotechnic devices during the 1995 hearings, but the "Waco Fact Sheets" used to prepare for her testimony were produced to Congress. In addition, FBI and Department of Justice officials told congressional staffers, and possibly even members of Congress, that the FBI had used no pyrotechnic devices at Waco. The Department of Justice attorneys preparing for the hearings obtained the misinformation that the FBI had used no pyrotechnic devices from three separate sources at the FBI: James Atherton, an HRT explosives expert who had been at Waco on April 19; Monty Jett, an FBI munitions expert who had

assembled the tear gas delivery systems to be used at Waco; and Tony Betz, Unit Chief of the FBI's Domestic Terrorism Unit, who had been involved at Waco throughout the standoff and on April 19. None of these people knew that the FBI had in fact used pyrotechnic devices at Waco.

140. In response to the document requests, Congress received the notes of Reneau Longoria from 1993 that reference the use of a military round and describes it as "incendiary," Longoria's notes from Rogers' interview which refer to a military round, and the criminal prosecution team's witness chart that references Corderman's statement to the criminal prosecution team in 1993 that the FBI had fired a military round/bubblehead. These documents do not use the word "pyrotechnic" to describe the military tear gas rounds.

141. Congress also requested that the Department of Justice produce the FBI FLIR tapes recorded from 6:00 a.m to 6:00 p.m. on April 19, 1993. In response to this request, the Department of Justice produced only tapes from the second shift, beginning at 10:42 a.m., maintaining that the government did not have tapes from earlier in the morning. The Department of Justice and FBI took a similar position in response to a lawsuit filed under the Freedom of Information Act seeking access to the FLIR tapes. An FBI supervisory special agent submitted a sworn declaration which detailed all of the files that the FBI had searched for responsive information, and erroneously stated that the "earliest FLIR videotape recorded on April 19, 1993, occurred at approximately 10:42 a.m."

142. During the 1995 congressional hearings, prosecutor Ray Jahn submitted a written statement to Congress that "the FBI did not fire a shot, other than the nonlethal ferret rounds which carried the CS gas." No one questioned him about this statement, and the issue of the use of pyrotechnic devices did not surface during the course of the hearings.

143. The congressional committees issued a Report on August 2, 1996, which concluded, among other things, that the FBI's strategy decisions during the 51-day standoff were flawed and "highly irresponsible" and the Attorney General's decision to assault the complex on April 19, 1993, was "premature, wrong, and highly irresponsible." The report also concluded, however, that the ultimate responsibility for the deaths at Waco lay with Koresh, and that the evidence indicated that some Davidians intentionally set fire to the complex. The Report stated that there was no evidence that the FBI discharged firearms on April 19 or intentionally or inadvertently caused the fire. The Report also exonerated the armed forces of any wrongdoing relative to the *Posse Comitatus* Act.

T. The Surviving Davidians and Relatives of Deceased Davidians File a Wrongful Death Lawsuit.

144. On March 21, 1994, the first of seven groups of surviving Davidians and relatives of deceased Davidians filed a wrongful death lawsuit against the United States and certain individual FBI and Department of Justice employees in the United States District Court for the Southern District of Texas, Houston Division. The seven cases were consolidated on January 16, 1996, and the various groups of plaintiffs filed a single consolidated complaint. Upon motion by the United States on April 4, 1996, the Court transferred the case to the Western District of Texas, Waco

Division. The plaintiffs alleged that agents of the United States used excessive force on February 28, during the siege, and on April 19, and that they had failed to provide adequate emergency services and committed other intentional acts of misconduct or gross negligence in connection with their handling of the Davidian standoff at Waco in 1993. One such act alleged by the plaintiffs was that the government defendants caused "a fire in the Church which trapped and killed the [Davidians.]"

145. In January 1996, the plaintiffs in the civil suit filed a declaration by their fire expert, Richard Sherrow, in support of their opposition to the government's motion to dismiss the

Did the plaintiffs prove by a preponderance of the evidence that the Bureau of Alcohol, Tobacco and Firearms (ATF) used excessive force on Feb. 28, 1993, in either of the following respects?

The Court concurred with these findings in its opinion of September 20, 2000. The Court further concluded in its amended opinion of September 27, 2000 that the FBI did not fire gunshots at Waco on April 19, 1993.

⁹⁷On July 14, 2000, after a four week trial, an advisory jury returned a verdict in the civil case. In its verdict, the advisory jury answered "no" to each of the following questions:

^{1.} by firing at Mount Carmel without provocation.

^{2.} by using indiscriminate gunfire at Mount Carmel on Feb. 28, 1993. Did the plaintiffs prove by a preponderance of the evidence that the Federal Bureau of Investigation acted negligently on April 19, 1993, in one or more of the following respects?

^{1.} by using tanks to penetrate Mount Carmel other than in accordance with the approved Plan of Operations on April 19, 1993.

^{2.} by starting or contributing to the spread of the fire at Mount Carmel on April 19, 1993.

^{3.} by affirmatively deciding to have "no plan to fight a fire" at Mount Carmel, despite Attorney General Reno's directive that required "sufficient emergency vehicles to respond both from a medical and any other point of view."

complaint and specifically its motion to dismiss the plaintiffs' claims regarding the fire. Sherrow stated that:

Besides the SGA-400 Ferret cartridges, information from documents obtained from the FBI through the United States Department of Justice indicates that military pyrotechnic munitions may have been fired into Mount Carmel. Documents disclosed indicate that agents could not penetrate either the underground shelter roof or the top of the rear four-story tower with Ferrets. Therefore, they fired at least one "military" round and referred to this munition as a "bubblehead."

146. Marie Hagen, the Department of Justice attorney heading the civil case asked FBI attorney Jacqueline Brown for help in responding to these allegations. Brown in turn faxed the Sherrow declaration to Monty Jett at the FBI, along with a note asking for assistance in responding to the declaration. HRT Special Agent Robert Hickey also received a copy of the declaration. On February 15, 1996, Hickey sent a memorandum to Brown, stating in relevant part, that the FBI HRT Charlie Team had fired "[a] total of two (2) or three (3)" military rounds at the roof of the underground shelter outside the complex. He stated that the rounds were fired shortly after 6:00 a.m., 99 bounced off the roof, and landed in the field behind the complex. Hickey noted that "the military CS rounds were prohibited from being fired into the main structure due to their potential for causing a fire." Brown read the memorandum and made notations regarding this paragraph.

⁹⁸Document discovery in the civil case did not begin until July 1999. Therefore, the "documents" referred to by Sherrow came from other sources. Most likely, the documents were Longoria's notes which were produced to Congress in 1995, and the criminal prosecution team's witness chart which was produced to Congress in 1995 and to the plaintiffs in a related Davidian civil case in 1994. Both of these documents contain the term "bubblehead."

⁹⁹In fact, the rounds were fired at approximately 8:08 a.m.

Declaration in 1996 because it did not consider the allegations germane to the main issues in the case. In 1997, the plaintiffs filed a supplemental declaration by Sherrow which again alleged that the HRT had used military tear gas rounds on April 19. In a brief filed on March 19, 1998, the government dismissed Sherrow's statement that the FBI fired pyrotechnic rounds on April 19, 1993, with a footnote stating that Sherrow "ignores the virtual arsenal gathered by the Davidians," clearly suggesting that the Davidians had fired the military tear gas rounds at the FBI. Brown reviewed the brief before it was filed. After the FBI publicly acknowledged using military tear gas rounds in August 1999, the Department of Justice filed a pleading withdrawing this statement.

148. As the civil lawsuit proceeded, Dan Gifford and Michael McNulty (among others) produced and released the film *Waco: Rules of Engagement*. The film included portions of the FLIR tapes from after 10:42 a.m. The producers noted the flashes emanating from the complex and around government vehicles which they claimed evidenced a gun fight between the government and the Davidians. The producers also noted objects on the FLIR tapes which they claimed were persons exiting the government vehicles and assuming positions to fire shots into the complex. The plaintiffs in the civil lawsuit seized upon this information to support their allegations that the government had contributed to the deaths of the Davidians by shooting into the complex, pinning the Davidians down, and preventing their escape. The government continued to assert that the FBI had not fired a single shot at Waco on April 19, 1993. Its experts stated that the flashes on the FLIR tapes were reflections from debris on the ground, a theory dismissed as impossible by the plaintiffs' experts.

149. In 1997, as part of the preparation of the defense in the civil litigation, various Department of Justice and FBI officials debated internally the desirability of conducting a test of the FBI's Nightstalker FLIR equipment to determine whether gunfire could appear on a FLIR tape and to determine whether debris could cause flashes on a FLIR tape. Those favoring the test noted that the FBI intended to upgrade its FLIR system soon and recommended that the test occur immediately. The test never occurred, and the FBI upgraded the equipment.

U. Events in 1998 and 1999 Lead to the Appointment of the Special Counsel.

150. On August 21, 1998, after consulting with Department of Justice public affairs officials, Assistant United States Attorney Johnston allowed McNulty, who was working on another Waco film, access to the Waco evidence storage facility. McNulty inspected the evidence on this and three to five subsequent occasions. During one of his visits, McNulty located the military tear gas shell (Exhibit Q1237) referenced earlier. McNulty already had the photograph of the missing military tear gas projectile which had been produced to the Davidians in the criminal trial, and recognized it as a pyrotechnic device. McNulty did not initially disclose his findings to the public but continued to seek additional information from the Department of Justice and other sources through correspondence.

151. On June 14, 1999, the Texas Department of Public Safety began an evidence review in the course of preparing a motion to transfer custody of the Waco evidence to the Court. The Ranger leadership assigned Sergeant Joey Gordon to conduct the review and instructed him to review carefully evidence that the Rangers had made available to McNulty. While reviewing the

evidence, Sgt. Gordon initiated an investigation of the 40 millimeter military tear gas round shell, Exhibit Q1237.

- 152. On July 28, 1999, *The Dallas Morning News* published an article reporting that the head of the Texas Department of Public Safety had stated that evidence held in the custody of the Rangers called into question the federal government's claim that its agents used no incendiary devices on April 19, 1993. A spokesman for the Department of Justice dismissed the allegation as "more nonsense." Attorney General Reno responded at her weekly news conference, as quoted by *The Dallas Morning News* in an article published July 30, 1999, that "I have gone over everything, and I know of no such evidence."
- 153. On August 19, 1999, while preparing for the civil trial, Department of Justice civil attorney James Touhey conducted a database search for the term "bubblehead" which he had seen in the Sherrow Declaration. He found the 1996 Hickey memorandum to Brown discussing the use of the pyrotechnic military tear gas rounds by the FBI at Waco, as well as Longoria's notes from the Corderman interview and the witness chart referring to the use of "military rounds" and "bubblehead." Touhey contacted Brown, but she said that she had no recollection of the Hickey memo. Touhey faxed a copy of the memorandum to Brown on August 19, 1999.
- 154. *The Dallas Morning News* continued to report on the release and surrender of custody of the Waco evidence. In response to a request for comments on the allegations regarding pyrotechnics, a Department of Justice spokesman told *The Dallas Morning News* on August 23,

1999, that "[W]e are aware of no evidence to support the notion that any pyrotechnic devices were used by the federal government on April 19." *The Dallas Morning News* reported this statement on August 24, 1999, along with the news that former FBI Deputy Assistant Coulson now confirmed that the FBI had fired pyrotechnic devices on April 19, 1993. On August 25, the FBI confirmed that it "may have used a very limited number of military-type CS gas canisters on the morning of April 19...." In the following days, the national media picked up the story and began to raise serious questions about whether the Department of Justice had been forthright with the American people concerning the conduct of the FBI on April 19, 1993. In addition, on August 27, 1999, *The Dallas Morning News* reported the presence of military Special Forces personnel at Waco, stating a source had indicated that members of a secret Army unit were "present, up front and close" during the FBI operation of April 19, 1993.

155. On August 30, 1999, Johnston wrote Attorney General Reno, claiming that he had been unfairly chastised for letting McNulty view the physical evidence in the possession of the Texas Rangers and suggesting that Attorney General Reno had been misled about the FBI's use of pyrotechnic devices on April 19, 1993.

156. In August 1999, in response to a request from Jacqueline Brown dated August 14, 1999, several FBI agents gathered all Waco-related materials that had been held at HRT headquarters and took the materials, with an inventory, to Brown on August 26, 1999. These materials included a FLIR tape which the inventory tag described as "Night Stalker 4/19/93 Tape

#1 5:57 am - 8:00 am." Within a few days Brown recognized that she had not previously seen this tape and brought it to the attention of her supervisor at the FBI.

157. On September 1, 1999, FBI attorney Elizabeth Beers called the Unit Chief for the Aviation Special Operations Unit ("ASOU") Isaac Nakamoto and asked him to search again for April 19, 1993, FLIR tapes. In the subsequent search, the FBI located two additional FLIR tapes in an unlocked ASOU filing cabinet in the office of the Supervisory Aviation Specialist. These tapes are from 5:59 a.m. to 7:56 a.m. and from 7:57 a.m. to 9:28 a.m.

158. In early September 1999, the FBI disclosed publicly the existence of additional FLIR video recordings which it had previously claimed did not exist. On September 2 and 3, 1999, the FBI press office released the morning FLIR recordings, including the audio, which confirmed the firing of the pyrotechnic military tear gas rounds at the concrete construction pit shortly after 8:00 a.m. on April 19, 1993.

159. As a result of the public release of information from the newly discovered FLIR tapes, the public disclosure of the military tear gas casing and the photograph of the military projectile, and new information about the presence of Army Special Forces personnel at Waco, on September 1, 1999; at the suggestion of FBI Director Louis Freeh, Attorney General Reno sent U.S. Marshals to the FBI to confiscate Waco-related evidence. Then, after first considering allowing the FBI to investigate the matter, she decided to appoint a Special Counsel to investigate questions about the conduct of the FBI at Waco, and whether any government official had covered up information

about the incident. On September 9, 1999, Attorney General Reno appointed former United States Senator John C. Danforth as Special Counsel, issued Order No. 2256-99 defining his charter, and recused herself from further involvement in the Waco matter.

* * * * * * * * * * * * * * * * * * *

This concludes the Special Counsel's Final Report to the Deputy Attorney General.

The Office of Special Counsel attaches hereto:

Exhibit 1 (Order of the Attorney General);

Exhibit 2 (Statements of Individuals Named in the Report); and

Exhibit 3 (Diagram and photographs of Davidian Complex), and the following appendices:

Appendix A, Branch Davidian History;

Appendix B, Summary of Expert Findings;

Appendix C, Chronology of Events;

Appendix D, The Final Report of Office of Special Counsel Expert, Walter Wetherington;

Appendix E, The Final Report of Office of Special Counsel Expert, Dr. Ulf Wickström;

Appendix F, The Final Report of Office of Special Counsel Expert, Dr. Jerry Havens;

Appendix G, The Final Report of Office of Special Counsel Expert, Chris Mills;

Appendix H, The Final Report of Office of Special Counsel Experts, Lena Klasén and

Sten Madsen;

Appendix I, The Final Report of Office of Special Counsel Experts, Vector Data

Systems (U.K.) Ltd.;

Appendix J, The Final Report of Office of Special Counsel Expert, Dr. Michael Graham;

Appendix K, The Final Report of Office of Special Counsel Expert, Dr. George Lucier;

Appendix L, The Final Report of Office of Special Counsel Expert, Dr. Uwe Heinrich;

Appendix M, The Final Report of Office of Special Counsel Expert, William George;

Appendix N, The Final Report of Office of Special Counsel Experts, Dr. Gerry Murray and David Green.

FINAL REPORT

CONCERNING

THE FIRE AT THE BRANCH DAVIDIAN COMPLEX WACO, TEXAS APRIL 19, 1993

PREPARED FOR

THE OFFICE OF SPECIAL COUNSEL WACO INVESTIGATION

BY

WALTER WETHERINGTON FIRE INVESTIGATOR

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1. Introduction

1.1 Background

On December 7, 1999, I was retained by the Office of Special Counsel to evaluate the U.S. Government's independent fire investigation and review evidence related to the fire that destroyed the Branch Davidian complex on April 19, 1993. I was tasked to answer the following questions:

- Did agents of the United States start or contribute to the spread of the fire that killed members of the Branch Davidian group on April 19, 1993;
- Did the United States Government's independent fire investigation accurately and completely define the cause of the fire and its point(s) of origin;
- Can additional information be developed concerning the cause and/or point(s) of origin of the fire; and
- Could firefighters have controlled or stopped the spread of the fire.

1.2 Review of Visual and Documented Evidence

To answer the questions I conducted a careful review of investigative disciplines and methodology utilized by the United States Governments' original fire investigation team.

I have also completed an exhaustive review of documents and visual evidence that relate to the Waco fire and the subsequent investigation. I have examined a wide variety of material including, but not limited to, the following:

Reports

- Orientation materials from the Office of Special Counsel
- Fire investigation report, Congressional testimony and civil litigation testimony of Paul Gray, Department of Justice expert
- Fire investigation report of William Cass, Department of Justice expert
- Fire investigation report of Thomas Hitchings, Department of Justice expert
- Fire investigation report of John T. Ricketts, Department of Justice expert
- Fire investigation report, Congressional testimony and civil litigation testimony of Dr. James G. Quintiere, Department of Justice expert
- Laboratory report of Andrew Armstrong, Department of Justice expert
- Report of John Kaus and John Hudec, accelerant detection dog handlers
- Reports by W. Gene Corley, Hans C. Kosel, and Brian G Stejskal with Construction Technology Laboratories, Department of Justice experts
- Deposition by W. Gene Corley, Department of Justice expert

- Report and civil declaration by Richard L. Sherrow, Branch Davidian expert
- Final report of Patrick M. Kennedy, Branch Davidian expert
- Final report of Systems Engineering & Laboratories Corporation, Branch Davidian expert
- Final report of Andrew Armstrong, Department of Justice expert
- Final report of William Cass, Department of Justice expert
- Final report of Thomas Hitchings, Department of Justice expert
- Final report of James G. Quintiere, Department of Justice expert
- Final report of John Ricketts, Department of Justice expert
- Final report of Michael O. McNamee, Department of Justice expert
- Deposition by Michael O. McNamee, Department of Justice expert
- Final report of Construction Technology Lab, Department of Justice expert
- Deposition of Davidian Graeme Craddock
- Deposition of Dr. Andrew Armstrong, Department of Justice expert
- Vector Data Systems (U.K.) Ltd. Final Report

Videos and Photographs

- Four Forward Looking Infrared video tapes taken by the FBI on April 19, 1993
- Photographs of the Branch Davidian complex fire taken by the FBI (CDs and zip drive-each containing different photographs)
- Video tape "Major Network News Footage" created by the Office of Special Counsel
- Video tape "Fire Footage, Mt. Carmel" created by the Office of Special Counsel
- VHS tape created by the FBI laboratory, and used by Dr. Quintiere in preparing his final report concerning Branch Davidian fire
- Three CDs containing fire photographs, scanned at 600 dpi or higher resolution
- VHS tape copy- KWTX fire coverage
- VHS tape of fire coverage complied by the Office of Special Counsel
- Twenty-six (26) VHS tapes created by Texas Department of Public Safety of Branch Davidian complex after the fire and during crime scene processing
- Photographs and Video tapes showing Texas Department of Public Safety crime scene security with personnel and tape around perimeter of fire scene
- VHS tape of Methylene Chloride (MC) Experiments
- Two hundred seventy-one (271) photographs of fire on April 19, 1993, from Office of Special Counsel
- One comprehensive set of video tapes containing all available FBI and media coverage of the fire on April 19, 1993
- Five hundred and three (503) crime scene photographs (with index)
- VHS Tape "The Big Lie"

Maps, charts and logs

- Various diagrams and drawings of the Branch Davidian complex
- Fire scene sector and grid plotting of fuel containers, lanterns, lantern parts and knives prepared by investigators of the Office of Special Counsel
- Crime scene sectors used for examination and evidence collection by the U.S. Government's fire investigators
- Texas Department of Public Safety crime scene evidence logs
- Texas Department of Public Safety crime scene photograph logs
- Laboratory report by William J. Stokes of the FBI Laboratory

Miscellaneous

 Briefing Materials prepared by Kennedy & Associates for the Office of Special Counsel

1.3 Work Performed and Review of Actual Evidence

1.3.1 Work Performed

The following is a summary of the work I performed in the course of my investigation:

- Participated in a conference of Office of Special Counsel experts at the Office of Special Counsel Washington, D.C. office, addressing the Branch Davidian complex fire investigation.
- Spent three days at the Office of Special Counsel in Saint Louis, Missouri, meeting with staff, reviewing photographs and evidence of the Branch Davidian complex fire investigation. Developed plans for further investigation.
- Traveled to Peterborough, England where I met with experts for the Office of Special Counsel Vector Data Systems, David Oxlee, Nick Evans, Robert Scully and Dr. Ulf Wickstrom, Head of the Department of Fire Technology at the Swedish National Testing and Research Institute. During this meeting we discussed all aspects of the FLIR tapes as they related to the fire locations and time sequence for the spread of the fire. We also made comparisons between the FLIR and other photographs and videos.
- Participated in conference calls, conferences, letters and faxes with the Office of Special Counsel.
- Traveled to Waco, Texas, with Office of Special Counsel investigators on three occasions to examine fire evidence. I spent a total of fourteen days conducting these examinations. This time also includes a visit to the Branch Davidian complex

site for a better perspective of the layout. Attended interviews conducted by the Office of Special Counsel investigators, including Dr. Andrew Armstrong, in Arlington, Texas, and Texas Ranger Sgt. Lane Akin in Decatur, Texas.

1.3.2 Review of Physical Evidence

- My examination of the physical fire evidence began on March 29, 2000. All fire related evidence located at the Federal Court in Waco was examined. Evidence maintained by the Court offsite and in the large conex containers was also examined. I made these examinations to, determine among, other things, (1) the thoroughness of prior investigations, (2) whether the evidence supported one or more points of origin; and (3) who may have started the fire(s).
- I examined all metal cans recovered from the Branch Davidian complex debris. A total of thirteen (13) had puncture holes that appeared to be created intentionally. I plotted these cans on a sector/grid map for their relationship to the separate fires. The Office of Special Counsel toolmark expert conducted a further examination of these cans. My review of these cans and the results of the examination are further covered under Physical Evidence of Arson 4.2.1.
- I examined all items of clothing that contained evidence of accelerants, including jackets, shoes, and pants. This examination is further covered under 4.2.3, Accelerants on Davidian Clothing.
- A large percent of evidence had to be sifted by hand due to the minute size of the pieces. These very small pieces helped confirm building materials and to assist in establishing fire load within the complex. The information gathered from the building materials was provided to Dr. Ulf Wickstrom, an expert for the Office of Special Counsel. Based on this review, I identified many of the building materials. The materials located were consistent with those identified by experts for the Branch Davidians and the Department of Justice. I further compared these findings to photographs of the complex and statements made by Davidians concerning the building construction. This is further covered under 2.2.2, "The Branch Davidian Complex Structure and Its Contents."
- I also examined all the propane tanks recovered from in and around the Branch Davidian complex. Only one tank showed effects consistent with a "bleve" or a boiling liquid vapor explosion. This bleved tank was located on the exterior of the complex adjacent to the central tower and concrete bunker. I understand that Office of Special Counsel expert, Dr. Jerry Havens, is addressing the damage to this propane tank. Four of the remaining propane tanks had the valves removed before the fire and were empty at the time of the fire. The propane tanks recovered from the scene had nothing to do with the separate fires inside the complex.

• Access to the evidence was coordinated between Office of Special Counsel investigators and the Clerk of the United States District Court for the Western District of Texas. Times of examination were in accordance with the Western District of Texas requirements and all evidence was resealed after examination. Texas Ranger Sgt. Lane Akin assisted, for a short time, during the last part of my evidence examination. He pointed out some of the areas at the Branch Davidian complex where evidence was collected. He also identified a torch that was collected from the Branch Davidian complex cafeteria. A discussion concerning this torch is covered under The Torch, 4.2.2.

1.4 Conclusions

A very careful and detailed examination was made of all the above evidence. The evidence and photographs were examined and then reexamined several times. Photographs were examined using a large shop magnifying glass with an electric bulb. I also enlarged selected photographs to resolve further detail. Many of the videotapes were replayed frame-by-frame for detail and referred to many times before any determinations were made. Cross checks was made between photographs, videotapes and other reported information for comparisons and to verify the conclusions. From my examination of all the evidence, I conclude with absolute certainty that there were three points of fire origin within the Branch Davidian complex. Evidence further supports that each of these fires was intentionally started by the Davidians.

2 The U. S. Government's 1993 Fire Investigation

2.1 Summary

I reviewed all the fire-related material available to the Office of Special Counsel, including the Vector Data Systems, (U.K.) final report concerning the April 19, 1993, FLIR tapes. As noted in Section 1.3, I also met with Vector Data Systems in the United Kingdom to discuss their findings regarding the first visual sighting of fire on the FLIR tapes from April 19, 1993. I also examined physical evidence and viewed the scene. I am not aware of whether all of this information was available to the original fire investigators.

2.2 Assessment of the Structure and its Contents

To evaluate the structure and building materials I reviewed all available resources, including witness's statements and the U. S. Government Fire Investigators' reports. My review also included an examination of all physical evidence, fire debris in Court-maintained conex containers, ground level and aerial photographs, Texas Department of Public Safety crime scene photographs and videos, and TV networks videos. The fire load was not completely determined by the original fire investigators.

The materials used to construct the Branch Davidian complex consisted of the following:

The main structure was a multi-storied, wood-framed building in an irregular shape. Contained within the building on the ground floor were the men's living quarters, a kitchen and dining room with adjacent food storage area (concrete bunker), several utility rooms, a chapel and a gymnasium. The second floor was located over the entire length of the front of the building and above the food storage area, as well as in an area above the northeast portion of the chapel. The second floor was apparently used as quarters for women and children, and also contained the quarters of Vernon Howell, a.k.a., David Koresh. Both the southeast and southwest corners on the front of the building contained a third floor. A third and fourth floor were located over the food storage area (concrete bunker).

The building had been constructed haphazardly over a period of time, with no attention to existing building or fire codes. The building had no bathrooms or plumbing fixtures, with the exception of sinks located in the kitchen area. Lumber from other, previously demolished structures was used in the complex construction.

The interior foundation of the Branch Davidian Complex was made with a variety of materials that included the following: unreinforced concrete blocks and cinder blocks set directly on the earth; unreinforced concrete slabs; and poured concrete blocks made by using five gallon cans and one-half gallon milk containers

The exterior framing consisted of 2" X 4" and 2" X 6". The roof was constructed with of 3/8" plywood laid over 2"X 8" homemade trusses. Several types of flooring were used, including ½" plywood, 1" particleboard, and 1" particle board over 1" X 6".

The majority of the materials reported by the Government's Fire Investigators are consistent with my findings. Additional materials not identified in their findings are as follows:

The roof was covered with roofing felt # 15 STD. The roofing felt was then covered with two types of material, each on a different part of the roof. One section was covered with roll asphalt composition material and the other with fiberglass shingles with an asphalt base. The front side of the complex roof was covered with shingles from the apex of the roof to the overhang. This can be seen in FBI photograph 1071850, this photograph was taken from the White side, ground level. The remainder of the roof was covered with roll roofing. See appendix P, photographs of building materials.

The first floor (excluding cafeteria) and second floor walls and ceilings were covered with ½" drywall, also referred to as sheet-rock. Drywall on the second floor can be seen in FBI photographs 1071851, 1071852, 1071864, 0850082 and 1071877. See Appendix P, photographs. These photographs were on the ground level. See Appendix P, photographs of building materials. There were no doors to the rooms on the second floor.

The exterior walls were covered with two types of material, each on a different part of the exterior wall. The first type ½' T1-11 panels covered the entire structure except the wall of the cafeteria Black side and the tower over the concrete bunker. The cafeteria wall and tower were covered with wood boards approximately ½ "thick."

2.3 Seizures and Processing of Evidence

The arson evidence was properly seized and processed. My conclusions are based upon witness statements, examination of the evidence, photographs and video tapes after the fire, evidence logs, plotting sheets, chain of custody and transfer of evidence, laboratory evidence receipts and findings. The security of the scene and sectors used for searching were also reviewed. A copy of the search grid is attached as Appendix L. Photographs of the search scene are included in Appendix L, Photographs L-2 and L-3.

2.4 Accelerant Detection Canine Reliability

After careful review of the manner in which the accelerant canine was utilized at the Branch Davidian fire scene, I conclude that the accelerant canine was used properly by the fire investigators. The handlers, Fire Marshal John Kaus and Detective John Hudec, were well trained in the handling of accelerant canines. The canine, a black Labrador retriever named "Onyx," was certified in the detection of accelerants.

The manner in which an accelerant canine is used is a discretionary decision. This decision is typically based on the type of scene to be examined. An accelerant detection canine should only be used as a tool to locate flammable liquids for laboratory analysis. They should not be used to determine the fires' points of origin. In this case, Kaus and Hudec used Onyx only to locate liquids for laboratory analysis.

Every piece of evidence collected from the Branch Davidian complex that the laboratory identified as containing flammable liquids also received an alert by the accelerant canine. There were however, many other alerts by the canine where the laboratory was unable to find flammable liquids. This is not unusual, as the dog's nose is often more sensitive than the laboratory equipment. Incidentally, fire investigators frequently encountered the same type problem. Although they may smell a petroleum product in the fire debris, when the debris is analyzed it comes up negative for accelerants. The original fire investigators did not make the mistake of relying solely on Onyx's alerts, and focused solely on accelerant evidence confirmed by the canine and the laboratory.

For the purpose of my report, I too, rely solely on those accelerant detections confirmed by both the canine and the laboratory.

2.5 Chemical Analysis of Evidence and Structural Debris

I conclude that the laboratory analysis performed by Dr. Andrew Armstrong was properly conducted. Moreover, Dr. Armstrong's results are supported by the flammable liquids identified

by the accelerant canine. Based on Dr. Armstrong's findings, I conclude that most of the Davidians who escaped the fire had some type of flammable liquid on their clothing. Two people were wearing jackets that had sizeable burn effects. In fact, the type of burn on one of the jackets, coupled with burns to the individual's hands, are consistent, in my experience, with those of a fire starter.

Dr. Armstrong's report also supports flammable/combustible liquids at the following point(s) of fire origin:

- (1) In the southeast corner, a cloth-containing residue of a heavy petroleum distillate was found, DPS# 796.
- (2) In the chapel, six different evidence samples containing flammable liquids were found. Four of these samples contained kerosene, DPS# 76, 77, 78, and 79; one contained a mixture of gasoline and kerosene, DPS# 74; the final one contained gasoline DPS# 44.
- (3) A sample taken from the kitchen/serving port area also contained gasoline DPS# 1176.

A test for flammable liquids was negative on the torch located in the cafeteria. This is not unusual considering the amount of fire. See Appendix O, "Sketch of Complex," for fire evidence locations.

2.6 Cause and Origin Determination

The U. S. government fire investigation accurately defined three point(s) of fire origin in the complex. These locations were the southeast corner, cafeteria, and rear of the chapel. The Government's fire investigators also accurately concluded that the fire was intentionally started by the Branch Davidians inside the complex. The fires started within two to three minutes of one another. See Appendix G, "Photograph Points of Origin of the Three Fires."

2.7 Conclusions

All investigation materials and expert opinions submitted by the government's fire investigators Paul Gray, William Cass, Thomas Hitchings, John Ricketts, and fire dynamics experts Dr. James G. Quintiere and Dr. Frederick W. Mowrer were thoroughly reviewed and considered. Materials and opinions of Branch Davidian experts were also taken into consideration before any final conclusions were made.

I believe there was a lack of follow-up and coordination among the Government's fire investigators. There appears to have been little or no coordination on their reports and requests for various forensic tests to support the investigative findings were not submitted. Although

these failures did not materially affect the accuracy of their findings, it did affect the completeness and cohesiveness of their final report.

3. The Origins of the Branch Davidian Complex Fire

3.1 Summary

Based upon my review of all the available physical and documentary evidence, I conclude there were three (3) separate, distinct and unconnected fires in the Branch Davidian complex. All three of these fires were started nearly simultaneously. There is also ample evidence to support combustible materials, such as hay, had been placed at different locations throughout the complex. Evidence also supports flammable liquids being poured in the complex in addition to the three points of origin. Dr. Ulf Wickstrom, a fire dynamics expert retained by the Office of Special Counsel, examined the spread and sequence of the fires. We have coordinated in our investigative findings.

3.2 Fire A: The Cafeteria

The first visible indication of smoke from the fire came from the (Black Side) of the Branch Davidian complex. More specifically, the smoke escaped the back of the cafeteria and traveled towards the Green Side and away from the complex. As shown in photographs H 11-H13 of Appendix H, the smoke from the back of cafeteria appears moments before smoke erupts from the Southeast Corner of the Complex. This first visible smoke occurs at approximately 12:07 p.m.

Vector Data Systems' (U.K.)'s Final Report to the Office of Special Counsel states that a heat source from the cafeteria appears at 12:08:26. The report further points out that the cafeteria heat signature was a strong signature indicating that the heat was intense at that location. In fact, they conclude that the signature was stronger than the one seen in the Southeast Corner at 12:07:43.

The fire located in the cafeteria was along the eastside of the room, next to the concrete bunker, and then extending in a northeast direction. See Appendix H, Photographs H-1 through H-7 that shows the fire in the initial stage. No smoke or fire is seen coming from the left side of these photographs or from the southeast direction. See Appendix H, Photographs H-8 through H-10.

The witness statement of Marjorie Thomas, who was on the second floor close to the steps that lead down to the kitchen area, stated she first observed fire through cracks on the second floor. Davidian Thomas was likely observing the cafeteria fire on the first floor.

Combustible materials located in the cafeteria included the remains of hay, and eight 20-pound and one 35-pound propane tank. These tanks were located at the south side of the

cafeteria adjacent to the concrete bunker, four did not have valves, the threads were not stripped and all were empty. Although these tanks were present in the cafeteria, I do not believe they were responsible for the fire at that location.

A torch was also located in the cafeteria next to the Black Side wall. This is where the fire was first observed coming from the cafeteria through the exterior wall. The recovery of the torch, although not conclusive, is evidence of an intent and highly suggestive of a plan to start a fire at this location. See section 4.2.2, "The Torch," for further description and also Appendix M, for Photographs. Four one-gallon fuel cans were also recovered from the cafeteria. These cans had no holes but are logically involved with the fire at this location. I believe the fire in the cafeteria is also connected with two punctured fuel cans with puncture holes and traces of gasoline located at the door to the cafeteria. See Appendix O, "Sketch of Complex: Fire Evidence Locations and Grid Sketch."

3.3 Fire B: The Southeast Corner

A second fire was started in the southeast corner on the second floor of the complex, adjacent to the roofline of the chapel. See Appendix I, "Photographs Origin of Fire- Southeast Corner." See also Appendix D, "Photographic Fire Sequence, Red Side D-1 through D- 36."

Vector Data Systems (U.K.), in their final report to the Office of Special Counsel, stated the first FLIR visible outbreak of fire on the second floor of the Red/White corner occurs 12:07:43. Combustible materials located in the fire debris of the southeast corner (Fire B), included the following: small particles of wood, hay, remains of three single mattresses (springs), miscellaneous papers, small particles of clothing, curtains, and remains of two overstuffed chair (springs). A cloth located in the southeast corner also contained the residue of a heavy petroleum distillate. (Grid JA-1.) Two one-gallon fuel cans were also located in the same area. Nothing could be determined from these cans due to their rusted condition. I conclude that there was no other obvious purpose for these cans other than to support the fire started at this location. In Grid JB-1, a one-gallon can with holes was identified. I also believe that this can was used to spread fuel for the fire in the southeast corner and is covered under section 4.2.1.

3.4 Fire C: The Stage at the Rear of the Chapel

A third fire was started on the stage at the rear of the chapel. See Appendix J, "Origin of Fire-Stage/Gym J-1 through J-6." These photographs depict the erupting of a fire on the stage towards the rear of the chapel

Vector Data Systems in their final report to the Office of Special Counsel stated that the first visible evidence of fire coming from the collapsed walkway occurs at 12:10:21. They further indicated that this probably resulted from the spread of fire on the Red Side.

3.5 Conclusions

Both conventional photographs and FLIR imagery confirm three points of origin for the fire in the Branch Davidian complex: (A) Cafeteria; (B) The Southeast Corner; (C) The Stage at the Rear of the Chapel. The letters "A, B and C" are not intended to imply order of ignition. The outbreak of these fires was nearly simultaneously and within two or three minutes of one another. For photographic fire sequence of Mt. Carmel complex see Appendices B, C, D, E and F.

4. The Cause of the Branch Davidian Complex Fire

4.1 Summary

The physical evidence, the Title III Intercept tapes, witness statements and other documentary evidence clearly establish that three (3) separate and distinct fires were started by the Branch Davidians on the interior of the complex. These were intentionally set within a two or three minute time span. There was no external source for these fires. All fires were products of the Davidians' own design. As described in the previous section, the fires originated in the cafeteria, southeast corner and the stage at rear of chapel.

4.2 Physical Evidence of Arson

4.2.1 Fuel Cans

The puncture holes in the fuel cans located at four different areas inside the complex appear to have been by a knife blade or a bayonet. The significance of the cans with numerous, intentionally punctured holes shows that they were used to spread fuel for setting a fire and not for the intended purpose, to store fuel.

The use of punctured fuel cans is an expedient technique for the distribution of fuel with no regard for the safety of those individuals spreading the fuel or for others. The effect is similar to using a watering bucket with a spray for watering flowers. This method gives a wider distribution of fuel than from the can's normal opening and sustained burning when poured on other combustible materials such as hay, papers, mattress and stuffed chairs. Some of these types of combustible materials were located at all points of fire origin within the complex. Fuel containers were located at all of the points of fire origin, including containers that had not been punctured. This method of spreading fuel could also account for fuel on the clothing and shoes of the individuals spreading fuel. Cans that had numerous puncture holes would be of no value to fill a lantern or stove and, in fact, would be a hazard around any open flame.

Many arsonists have employed the technique of puncturing fuel containers for the purpose of setting a fire. The manner in which they are punctured and their placement are all factors to achieve a desired result. In the case of the Davidians, they obviously had no concern about getting the fuel on themselves as suggested by the number of holes in some cans.

I carefully evaluated the location of the punctured fuel cans and one punctured lantern base to determine how they related, if at all, to the points of fire origin within the complex. See Appendix O, "Sketch of Complex: Fire Evidence Locations and Grid Sketch" for the locations of the fuel cans and lantern base. See Appendix K, "Photographs Punctured Fuel Cans, "K-1 to K-20 to view the cans and K-21 and K-22 to view lantern base.

Three one-gallon fuel cans and a lantern base with puncture holes were found on top of the concrete bunker (Grid M-2) above where a large number of Davidians were located. This would also be indicative of the fact that fuel was dispersed at this location. There is no other logical purpose for taking fuel containers with holes and a punctured lantern base into the tower above the concrete bunker.

Two one-gallon punctured fuel cans were located next to the cafeteria entrance (Grid 1B-1.) This location is also in the serving area adjacent to steps leading to the second floor. It should be further noted that the gasoline was identified from laboratory analysis of debris at this same location. It is logical to conclude that the punctured fuel cans at this location and gasoline is connected with the fire in the cafeteria and possibly connecting to the concrete bunker.

A one-gallon fuel can with holes was located at Grid JB-1; this grid area is adjacent to the southeast corner where one of the fires was started.

Six one-gallon fuel cans with puncture holes were located in the chapel, Grids N-1, N-2 and N-7. The location of these cans is consistent with positive laboratory analysis for flammable liquids at six different points that also included the stage.

The fuel cans, along with other evidence, helped to establish the points of fire origin inside the Branch Davidian complex. The puncture holes to the fuel cans also established intent by the Davidians, and further eliminate as a possibility any accidental causes for the fires.

An examination was conducted by William George and John Kaltenbronn, toolmark experts for the Office of Special Counsel. Their examination included thirty-nine fuel cans plus a lantern base recovered from the fire debris. They established that fourteen (14) fuel cans and one lantern base had holes. From their examination they were able to conclude that three (3) of the containers plus the lantern base had puncture holes consistent with various tools. They also found that the additional eleven (11) fuel containers with holes could have been made by exploding ammunition or by tools. A large number of knives and bayonets were in evidence that could have been used to make the puncture holes.

Two one-gallon Coleman type fuel cans were crushed and these may or may not have had fuel in them at the time of the fire. The one-gallon cans were examined for any indication of tracks from CEVs. From physical examination, the cans did not show any unusual metal stress as if they were full when crushed. There is no reported evidence of any fire from the crushing of any container. A propane tank was also crushed with no indication of a fire as a result.

4.2.2 The Torch

Texas Ranger Lane Akin secured a torch and placed it into evidence as DPS # 2018. When he was interviewed and asked to point out where the torch was located in a sketch of the scene, he pointed out that it was just inside the cafeteria on the east side (Black Side). This is the same location, in the cafeteria, where the initial fire started. The torch is made of material wrapped around a piece of wood or broom handle. See Appendix M, "Photographs the Torch," M-1 through M-6. See Appendix O, "Sketch -Fire evidence location." There is no obvious purpose for the torch in this case, except to use for igniting the fire in the cafeteria.

4.2.3 Accelerants in the Branch Davidian Complex Debris

Accelerants located by the U. S. government fire investigators are consistent with their findings of separate fires in the southeast corner and chapel areas.

Gasoline was found at Sector/Grid I-B1. Specifically it was located in the area of kitchen/serving port between the opening to the kitchen/cafeteria and the steps to the second floor. This is also to the left front of the concrete bunker. This evidence is DPS# 1176. See Appendix O, "Building Sketch, Fire Evidence location."

A cloth was located at the point of fire origin in the southeast corner. This cloth was found to contain residue of heavy petroleum and is DPS# 796. See Appendix O, "Building Sketch, Fire Evidence location." Moreover, the witness statement of Davidian Graeme Craddock supports the fire in the South East Corner.

In the chapel area six (6) different samples were found to contain flammable liquids. Four of these samples contained kerosene, DPS# 76, 77, 78 and 79. One sample contained a mixture of gasoline and kerosene, DPS# 74. The sixth sample contained gasoline, DPS# 44. See Appendix O, "Building Sketch, Fire Evidence location."

- DPS # 76, Sector N, no grid number, concrete found to contain kerosene.
- DPS# 77, Sector N-2, soil and debris, found to contain kerosene
- DPS# 78, Sector N-2, soil and debris, found to contain kerosene.
- DPS# 79, Sector N-2, concrete, found to contain kerosene.
- DPS# 74, Sector N-4, concrete, found to contain mixture of gasoline and kerosene.
- DPS# 44, Sector N- 1, debris, found to contain gasoline. This would be at the Red side of stage.

The accelerants were all documented by laboratory analysis. The torch, photographs, videotapes and the witness statement of Marjorie Thomas support the fire in the cafeteria. The

gasoline sample and two one gallon fuel cans located in front of entrance to kitchen/cafeteria is believed to be connected with this fire. This is DPS# I-B1. See Appendix O, "Building Sketch Fire Evidence Locations."

4.2.4 Accelerants on the Davidian Clothing

Armstrong Laboratory and "Onyx," the accelerant canine, also confirmed the presence of accelerants on the surviving Davidians' clothing. The presence of accelerants suggests that Davidians had been handling flammable liquids or they were close to someone who was handling flammable liquids. Flammable liquids were found on the clothing of five (5) of the surviving Davidians. They were as follows:

- Misty Ferguson Kerosene on shoes -DPS# 0018B
- Clive Doyle –Camp Stove Fuel on shoes- DPS# 0019C
- Derek Lovelock Camp Stove Fuel on clothing DPS# 0024; Kerosene on clothing - DPS# 0024A; Camp Stove Fuel on shoes DPS# 0024 B
- Graeme Craddock Kerosene and gasoline on left shoe DPS# 0026 A
- Jamie Castillo Camp Stove Fuel on shoes DPS# 0022A

Clive Doyle's jacket and hands were also burned in a manner consistent with a "flashback" from a liquid fuel fire. Clive Doyle discarded his jacket when he left the fire. He had denied that the jacket belonged to him until his attorney stipulated that the jacket was his. The jacket was found to contain flammable liquids on both sleeves.

4.3 Davidian Admissions

Graeme Craddock has repeatedly stated to the Office of Special Counsel and prior investigators that he witnessed Davidians spreading fuel in the chapel area. He further stated that he heard Mark Wendell shouting, "Light the fire," and Pablo Cohen telling Wendell, "Make sure."

Clive Doyle allegedly made statements to the Texas Ranger that the fire was started intentionally using Coleman fuel as an accelerant. Doyle now denies that he ever made these statements.

4.3.1 Title III Intercept Tapes

The FBI also had Title III intercept devices inside the Branch Davidian complex on April 19, 1993. These devices intercepted the following conversations prior to the fire.

At 6:09 a.m., the intercepts recorded the following conversation among a group of Davidians:

Unidentified Male: Have you poured it yet?

Unidentified Male: Hm.

Unidentified Male: Did you pour it yet? Unidentified Male: In the hallway . . . yes. Unidentified Male: David said pour it right?

Unidentified Male: Do you need . . . Unidentified Male: Come on let's go.

Unidentified Male: David said we have to get the fuel on. Unidentified Male: Does he want it poured already?

Unidentified Male: We want the fuel.

Unidentified Male: Yeah.

Unidentified Male: We want some here.

At 6:15 a.m., the intercepts recorded this conversation:

Unidentified Male: Have you got the fuel . . . ready?

Unidentified Male: I already poured it. Unidentified Male: It's already poured.

At 6:22 a.m., the intercepts recorded the following conversation among the Davidians:

Unidentified Male: Nobody comes in huh?

Unidentified Male: Nobody's supposed to come in.

Unidentified Male: Right.

Unidentified Male: They got some fuel around here. Unidentified Male: Yeah . . . We've been pouring it.

Unidentified Male: Pouring it already.

Unidentified Male: We've got it poured already.

At 7:08 a.m., the intercepts recorded the following conversation among the Davidians:

Unidentified Male: That's good . . .

Unidentified Male: Real quickly you can order the fire yes.

Unidentified Male: Yeah.

At 7:20 a.m., the intercepts recorded the following conversation among the Davidians:

Unidentified Male: You've got to put the fuel in there too.

Unidentified Male: Is it dry?

Unidentified Male: Hey let's put loads of fuel in there.

Unidentified Male: Fuel.

At 7:21 a.m., the intercepts recorded the following conversation among the Davidians:

Unidentified Male: Is there a way to spread fuel there?

Unidentified Male: OK . . . what we do You don't know. Unidentified Male: I know that won't spread . . . get some more.

Unidentified Male: So we only light it first when they come in with the

tank right . . . right as they're coming in?

Unidentified Male: Right.

Unidentified Male: That's secure We should get more hay in here.

Unidentified Male: I know.

At 7:23 a.m., the intercepts recorded the following conversation among the Davidians:

Unidentified Male: You have to spread it all so get started OK?

Unidentified Male: Yeah . . . got some cans there.

Unidentified Male: Right here . . . two cans here . . . and that's . . . and the rest can

take em . . .

At 11:27 a.m., the intercepts recorded the following conversation among the Davidians:

Unidentified Male: There isn't any reason to go out there.

Unidentified Male: No.

[Vehicle noise]

Unidentified Male: Do you think I could light this soon?

Unidentified Male: They're bringing it right to the middle of the . . .

Unidentified Male: Whoa . . . whoa.

At 11:42 a.m., the intercepts recorded the following conversation among the Davidians:

Unidentified Male: We're near the point where we oughta be . . .

Unidentified Male: We've no . . . we're not to blame for that We're not to

blame.

Unidentified Male: Looks to me that you gotta . . .

Unidentified Male: You'll have to deal with that.

Unidentified Male: Go and get the kids. Unidentified Male: They'll go for the barn.

Unidentified Male: I want a fire on the front . . . you two can go . . .

Then, at 11:54 a.m., an unidentified male stated: "Keep that fire going . . . keep it." This was the last statement intercepted before the listening device ceased operating.

4.4 Eye Witness Statements

In addition to admissions of the Branch Davidians, several FBI agents saw Davidians acting as if they were starting a fire. For example, FBI Agent John Morrison testified that he observed an individual starting a fire in the front door foyer area. FBI Agent Charles Riley also observed a person making motions consistent with the spreading of accelerants in the chapel area just prior to the start of fire.

A second FBI Agent also observed an individual in the southeast corner bending over and observed smoke coming from a window of the southeast corner almost immediately thereafter.

4.5 Conclusions

I conclude with absolute certainty that the fires were intentionally set by the Branch Davidians at three separate locations inside the complex. The Davidians started the three fires at nearly the same time using accelerants to speed the spread of the fire. There is no evidence to suggest that the U.S. Government started these fires.

I have reviewed the Office of Special Counsel interim report and its discussion regarding pyrotechnic rounds being fired at the construction pit at approximately 8:00 a.m. on April 19, 1993. I agree that these military M 651 rounds did not start or contribute to the fire that destroyed the complex on April 19, 1993.

5. Fighting the Branch Davidian Complex Fire

5.1 Summary

Firefighters could not have controlled or stopped the spread of the fires had they responded on the first visual evidence of fire at approximately 12:09 p.m. My conclusions are based on more than twenty-nine years of experience in fire investigation, the response time from Waco to Mt. Carmel, set up, water application, wind velocity, the flammable liquids, type of materials burning, the three separate fires burning simultaneously and speed with which fire spread. By the time firefighters would have responded, the fires would have progressed beyond the point of no return.

5.2 Multiple Fires and Amount of Time to Escape

Nine Davidians escaped the fire on April 19, 1993. They are as follows:

Misty Ferguson Marjorie Thomas Ruth Riddle

All three of these women escaped from second floor windows, an area that had been widened by a CEV on the White side of the complex.

Renos Avraam

Avraam escaped through a window on the White side of the complex, and then jumped to the ground on the White side of complex.

Graeme Craddock

Craddock escaped through a first floor window of the chapel on the Green side of complex.

Clive Doyle David Thibodeau Derek Lovelock Jamie Castillo

All four of these men escaped through an opening made by a CEV in the chapel close to the stage on the Red side of the complex.

See Appendix N, "Photograph Davidians' Escape Routes."

If firefighters were not in danger due to Davidian gunfire and had responded immediately on first visual evidence of fire, they may have given Davidians additional time for escape from the first and second floor living quarters and the chapel. They probably would not have been of assistance to the people in the concrete bunker and dining area, considering the fire set by the Davidians in the cafeteria along side of the concrete bunker. The people in the concrete bunker probably had little or no chance to escape after the fires were set.

5.3 Conclusions

The damage caused by the CEVs increased the amount of time the Davidians had to escape the building by creating larger and more pronounced escape routes. These escape routes were much larger than the complex's own windows and doorways and took longer to be obscured by the fire. Thus, although the damage caused by the CEVs may have added to the intensity of the burning at some locations, this same damage increased the available time for escape. In fact, seven of the nine people who did escape used some part of the openings made by the CEVs.

The fires set by the Davidians on different ends of the building may well have trapped many of the occupants, regardless of the openings.

6. Branch Davidians' Critique of the Government's 1993 Fire Investigation

6.1 Summary

All the investigative materials and expert opinions submitted by the plaintiffs investigators, Patrick Kennedy and Richard L. Sherrow, were thoroughly reviewed and

considered along with all other expert opinions and evidence before arriving at any final conclusions.

6.2 Conclusions

The plaintiffs' fire investigation does not accurately and completely define the cause of the fires and point(s) of origin. Three (3) independent and intentionally set fires have been well established. These fires are clearly supported by the following:

- Witness statements
- Photographs-ground level and aerial
- FLIR tapes and analysis of these tapes by Vector Data Systems (U.K.)
- Title III Intercept tapes (enhanced version by experts for Office of Special Counsel
- Physical evidence and laboratory analysis
- A torch and four fuel cans found in the cafeteria at the point of fire origin and witness statement of Davidian Marjorie Thomas who first saw fire at this location.
- Two punctured one-gallon fuel cans and positive laboratory analysis for gasoline in debris in front of entrance to kitchen/cafeteria and left front of concrete bunker.
- Punctured fuel can located adjacent to the southeast corner fire and two other fuel cans at the point of origin. Laboratory analysis confirming flammable petroleum on a cloth at this location.
- Witness statement of Davidian Graeme Craddock supports the fire being started in the chapel. Six (6) punctured fuel cans were located in the chapel. Laboratory analysis supports that flammable liquids were spread in the chapel area with six separate positive findings of flammable liquids.

Davidian experts maintain that the government started the fire by knocking over a lantern in the southeast corner. The evidence clearly shows that a fire actually occurred in the kitchen/cafeteria area earlier than in the southeast corner. This has been documented with ground and aerial photographs, physical evidence, witness statements and experts for the Office of Special Counsel. A lantern part was recovered 11'3" from the Red wall and 18' from the White wall of the Red/White corner. Had a complete lantern been located in this corner of the complex its base would have survived the fire and remained amidst the debris.

Davidian experts also challenge the use of the FLIR tapes to support the finding of three separate and unconnected fires. It is noteworthy to mention that these same experts have attempted to make extensive use of the FLIR tape to illustrate other points about the Government's actions. The FLIR tapes have been corroborated with photographs videotapes physical evidence, witnesses and experts for the Office of Special Counsel. I find them to be a reliable tool for determining the events of April 19,1993. Thermal imaging is widely used by the fire service. See, for example, "Applications of Thermal Imaging" by S. G. Burney, T. L. Williams and C. H. Jones.

Finally Davidian experts question whether proper investigation procedures were followed (e.g. National Fire Protection Association standards). These standards are an excellent guide for

investigators and raise some valid points on procedures. They are, however, only a guide and are not mandatory unless adopted by a local, state or federal agency. The National Fire Protection Association is a non-profit organization and has no regulatory authority.

7. Final Conclusions

(1) Did agents of the United States start or contribute to the spread of the fire that killed members of the Branch Davidian group on April 19,1993?

No. Agents of the United States did not start the fire that killed members of the Branch Davidian group. The only contribution to the spread of the fire was openings made by CEVs that supplied additional ventilation which may have intensified the fire at certain locations. These openings also provided larger escape routes for the Branch Davidians. Three separate and distinct fires were started inside the Branch Davidian complex by the Davidians. No evidence was discovered that would support a single fire theory being responsible for all fires. These fires were of the Davidians own design and they further coordinated the execution and timing of initiation.

(2) Did the United States Government's independent fire investigation accurately and completely define the cause of the fire and its point(s) of origin?

Yes. The United States Government's independent fire investigation accurately defined the intentional cause of the fire and its point(s) of origin.

(3) Can additional information be developed concerning the cause and/or point(s) of origin of the fire?

Yes. Additional information can be and was developed by the Office of Special Counsel.

(4) Could firefighters have controlled or stopped the spread of the fire?

No. The firefighters could not have controlled or stopped the spread of the fire if firefighters had responded on the first visible sign of the fire.

Walter Wetherington September 12, 2000



Fire analysis of the events at Waco, Texas, 19 April 1993

Prepared for

The Office of Special Counsel

By

Ulf Wickström SP, Swedish National Testing and Research Institute Borås, Sweden September 2000



Executive Summary

This report describes the fire development in the Branch Davidian complex on April 19, 1993. The fire analysis is based on information made available to me by the Office of Special Councel ("OSC"). I have been in close contact with the OSC FLIR experts Lena Klasén and Sten Madsen, Linköping, Sweden, who have assisted me with interpretation of the imagery on the April 19, 1993, FLIR tapes. I have also been in contact with OSC expert Walter Wetherington, who examined the physical evidence relating to the cause and origins of the fire.

Based on my review of all the available evidence, analysis of the fire, and after consideration of the final reports and opinions of Drs. Quintiere and Mowrer¹, Mr. Kennedy⁷, and others, I conclude that fires were started by means of accelerants at many locations throughout the building. The fires commenced within a very short time interval, evidencing that occupants of the Branch Davidian complex deliberately started the fires. Many of the fires went out by themselves when the combustible liquid was consumed. Fires did, however, continue to develop in three separate locations, which can be concluded with certainty with or without support of the FLIR tape imagery.

The first fire, denoted *Fire A*, started at the stage in the rear of the chapel. The first visible heat image on the FLIR occurs at 12:04:23 on the catwalk over the stage. This fire spread quickly in the debris of the crushed building. When the fire spread to the asphalt felt roof a lot of black smoke developed. This fire spread slowly against the wind direction towards the chapel and merged at a rather late stage with the fire that started in the southeast corner Red/White tower, i.e. *Fire C*.

The second fire, denoted *Fire B*, started in the cafeteria/kitchen area of the Branch Davidian complex. This fire was very dangerous, as most of the Davidians seem to have taken shelter and were found dead near this part of the complex. Fire B was first discovered on the FLIR as a heat image at 12:08:10. TV footage of Fire B shows smoke streaming out from the north side of the cafeteria at 12:08:11. Ground photos of the cafeteria taken between 12:08:10 and 12:08:58 also show flames penetrating through the north wall of the cafeteria at the same position as the heat images on the FLIR.

The third fire, denoted *Fire C*, started on the second floor of the southeast tower of the Branch Davidian complex. This fire was first observed on the FLIR as a heat image at 12:07:41, and the first flames were seen on TV footage at 12:09:42. This fire developed quickly as mainly accelerants and other easily ignitable items burnt. The wind, however, cooled this fire thereby delaying its burn through of the structure and its spread into the complex.

Although the fire developed rapidly and started at three different locations, the occupants could all have escaped the fire if they so wanted except possibly those residing in the center bunker, who may have been trapped by a fire started near its only door.

The fire could only have been fought if the risks of being shot at and being killed could be neglected. If so, I believe the fire could have been successfully fought with adequate equipment and personal being on site, adjacent to the complex, and on alert when the fire started. The Office of Special Counsel has advised me, however, that fire fighters could not safely approach the complex until after 12:30 p.m. Under these circumstances the fire could not have been controlled or stopped.



Finally I conclude, that the hole in concrete bunker roof was created by the heat from the fire. It was not made by a demolition charge as claimed by some experts.

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Introduction 1

1.1 Assignment

The Office of Special Counsel retained me on January 21, 2000, to evaluate the U.S. Government's and Plaintiffs' Expert Fire Analyses and review evidence related to the fire that destroyed the Branch Davidian complex on April 19, 1993. The Office of Special Counsel specifically tasked me to:

- Determine whether agents of the United States started or contributed to the spread 1) of the fire that killed members of the Branch Davidian group on April 19, 1993;
- 2) Determine whether additional information can be developed concerning the cause and/or point(s) of origin of the fire;
- 3) Determine time of ignition for individual fires;
- 4) Determine whether fire fighters could have controlled or stopped the spread of the fire:
- 5) Determine whether the Branch Davidians had the opportunity to escape the fire;
- Determine whether the analyses of Dr. James Quintiere, the U.S. Government's 6) Fire Dynamics Expert and Patrick Kennedy, a Fire Dynamics Expert retained by the Branch Davidians, accurately and completely defined the cause of the fire and its point(s) of origin; and
- Determine whether heat from the fire affected the structural integrity of the 7) concrete bunker roof.

1.2 **Personal Qualifications**

The Swedish National Testing and Research Institute (SP) is a Swedish Organization headquartered in Borås, Sweden. The Swedish government owns the institute. The Fire Technology Department, which I have led since 1986, is one of the world's leading authorities in projects concerning materials reaction to fire, structural response to fire, media and equipment for extinguishing fires and fire dynamics. The SP primarily supports the Swedish Government and private companies based in Sweden and



throughout the European Union. Prior to being retained by the Office of the Special Counsel neither the Fire Technology Department of the SP nor myself had ever been under a direct contract to the U.S. Government. Executive and operational control of the SP is under its Board of Directors, all of whom are Swedish nationals.

The Office of Special Counsel selected me on the basis of my unique and extensive background in heat transfer and structural fire analysis. Internationally I have made contributions in the analysis of in-door structural fires. Prior to my engagement with the Office of Special Counsel I had no involvement with any investigation into the events occurring at Waco, Texas on April 19, 1993. Moreover, in advance of commencing work, I signed a statement promising my complete impartiality throughout the investigation and guaranteeing that I would not make public any information relating to the investigation. For my CV, see Annex E.

1.3 Source of data

All material for carrying out this assignment and writing this Report was obtained from the OSC. Table 1.1 contains a detailed list of the materials obtained.

Table 1.1 Material obtained from the OSC.

No.	Date	Item
1	01/03/00	Paul Gray: Fire Investigation Report
2	01/03/00	Patrick Kennedy: Fire Investigation Report
3	01/03/00	Frederick Mowrer: Fire Investigation Report
4	01/03/00	Dr. James Quintiere: Fire Investigation Report
5	01/03/00	Richard Sherrow: Fire Investigation Reports
6	01/03/00	Attorney General Briefing Book: 4-12-93. (Bates numbered
		SCSL001-0001 to SCSL 001-0104
7	01/03/00	Attorney General Briefing Book: 8-1-95. (Bates numbered SCSL003-/0002 to SCSL 003-0321
8	01/03/00	Thirteenth Report by the Committee on Government Reform and
		Oversight August 2, 1996
9	01/1300	Photographs from FBI of Branch Davidian Compound on April 19,
		1993
10	01/20/00	Photographs of the fire at Waco compound (CDs and zip drive – each
		containing different photographs)
11	01/20/00	Waco – Major Network News Footage – Tape No.1
12	01/20/00	Waco – Fire Footage Mt. Carmel – Tape No 2
13	01/2700	John Ricketts – Summary of Activities and Personal Observation, Fire
1.4	01/07/00	Report
14	01/27/00	John Kaus Fire Marshal Report
15	01/27/00	Thomas Hitchings Fire Scene Origin and Cause Examination
16	01/27/00	Bill Cass Fire Investigation Team Report
17	02/08/00	FBI Lab Reports File NO. 89B-SA-38851, Dated August 4,1993 (FBI10360351-FBI0360048)
18	02/08/00	FBI Lab Reports File NO.89B-SA-38851, Dated October 4, 1993
	0_, 00, 00	(USA WDTX 007-01667)
19	02/08/00	FBI Lab Reports File NO.89B-SA-38851, Dated December 6,1993
-		(Page 1-49)
20	02/08/00	OSC Group I, Packet A: Mt Carmel Floor Plan, Floors 1-4
21	02/08/00	OSC Group I, Packet B: Branch Davidian Cause of Death Color
		Coding Grid/Bunker Recovery Grid
22	02/08/00	OSC Group I, Packet C: Mt Carmel Side Views
23	02/08/00	OSC Group I, Packet D: First and Second Floor Plans



Table 1.1 Continue

Nr.	Date	Item
24	02/08/00	OSC Group I, Packet E: Maps and Diagrams of Mt. Carmel and
		Surrounding Area
25	02/08/00	OSC Group I, Packet F: Mt. Carmel Side Views
26	03/08/00	Final report of Patrick Kennedy (Plaintiff's expert)
27	03/08/00	Final report of System Engineering & Lab Corp. (Plaintiff's expert)
28	03/08/00	Final report of Andrew Armstrong (DOJ expert)
29	03/08/00	Final report of William Cass (DOJ expert)
30	03/08/00	Final report of Thomas Hitchings (DOJ expert)
31	03/08/00	Final report of Dr. James G. Quintiere (DOJ expert)
		1. VHS Branch Davidian Fire
		2. VHS Methylene Chloride (MC)
32	03/08/00	Final report of John Ricketts (DOJ expert)
33	03/08/00	Final report of Michael McNamee (DOJ expert)
34	03/08/00	Final report of Construction Technology Lab (DOJ expert)
35	03/16/00	4 CDs with additional fire photos
36	03/27/00	Two (2) levers and caps from expended hand delivered flash bang
		grenade (Evidence label No.A00811749)
37	03/27/00	Two (2) forty millimeter Ferret casings, wadding and projectiles of the
		type used by the FBI at the Branch Davidian complex in 1993
		(Evidence label No.A00811108)
38	03/27/00	Two (2) forty millimeter XM651E1 casings (military rounds) with
		spent projectiles of the type used by the FBI at the Branch Davidian
		comp lex in 1993 (Evidence label No.A00811102)
39	03/27/00	Two (2) forty millimeter Flash Bangs casings and projectiles fired
		from a M-79 Grenade Launcher
40	03/30/00	Six (6) CDs containing high resolution photos of the fire at the Branch
		Davidian complex
41	04/13/00	Two Coleman Model 290 A700 lanterns
42	04/13/00	One Coleman Model 220 lantern
43	04/13/00	One hurricane style glass antique lantern
44	04/13/00	One American Camper RK-12 kerosene style lantern
45	04/27/00	One (1) gallon of Coleman Lantern Fuel
46	05/11/00	Vector Data Systems (U.K.) LTD. Final Report
47	05/17/00	K-6 VHS Video tape with compiled fire footage
48	05/18/00	Four 2'x4' sections of 3/8'plywood
49	05/18/00	1 roll of asphalt roofing materials
50	05/18/00	1 packet of asphalt roofing shingles
51	05/18/00	1 roll of 15 STD roofing felt
52	05/18/00	T-1-11 (exterior)/2x4 Wooden Supports
53	05/18/00	T-1-11 (exterior)/2x4 Wooden Supports/1/2 Sheetrock (interior)
54	05/18/00	1/2 Masonite (exterior)/2x4 Wooden Supports
55	05/18/00	½ Masonite (exterior)/2x4 Wooden Supports/½ Sheetrock (interior)
56	09/15/00	Final report of Walter Wetherington

I made a very detailed examination of all the above materials and evidence. Photographs and evidence were examined and then re-examined several times. Many of

the videotapes were replayed one frame at a time for detail and referred to many times before any determinations were made. Crosschecks were made between photographs, videotapes, and other reported information for comparisons.

In particular the FBI video coverage sensitive to infrared radiation, FLIR (Forward Looking InfraRed), the Canadian Broadcast Corporation (CBC) television coverage and FBI aerial and ground color photos have been important sources for this investigation.



1.4 Work Performed

In addition to my detailed review of photographic and documentary evidence, analysis, and preparation of my Final Report, I participated in following meetings:

- Participated in a conference of experts at the Office of Special Counsel in Washington, D.C., addressing the Waco fire investigation.
- Traveled to Peterborough, England and met with and participated in a meeting
 with Vector Data Systems experts' (U.K.) David Oxlee, Nick Evans and Robert
 Scully and with Walter Wetherington, fire investigator. These are all experts for
 the Office of Special Counsel. We discussed all aspects of the FLIR tapes as
 they related to the fire locations, time sequence of the individual fires and
 comparisons with other photographs and videos.
- Participated in a conference call on the bunker damages with OSC explosive experts, Dr. Gerry Murray and Mr. David Green.
- Conducted three lengthy and comprehensive meetings with OSC experts Lena Klasén and Sten Madsen to analyze the FLIR tape of the Waco fire.

SP, at my direction, also conducted three types of scientific tests to provide additional data for the analysis of the Branch Davidian fire. These tests included:

- Bonfire Tests. A M651 military teargas round, a 40 mm teargas Ferret and a
 Flash Bang grenade were placed in a controlled bonfire of wooden cribs to
 analyze the deterioration of these items under extreme temperatures and to
 determine what could remain after a severe heating exposure. See Annex A.
- Heat penetration tests of roof structure materials. Reconstructed samples of the Branch Davidians complex roof were exposed to fire on their underside. These tests were carried out in a small furnace to determine how long it takes until the temperature starts to rise on the unexposed side of the roof. See Annex B.
- Cone Calorimeter tests. Heat release test were carried out on sheets of wooden products believed to have made up the exterior walls of the Branch Davidian complex. The purpose of these tests was to determine the ignition and burning properties of the wood product, and the length of time to burn through the test materials. See Annex C.

1.5 Photos

Photos and other figures have been used extensively in this report for illustration purposes. They have been placed in the body of the text for clarity and convenience. The pictures have been cut to highlight certain details but have not been manipulated in any other way. The FLIR imagery frames have been obtained on CDs from OSC experts Klasén and Madsen.



1.6 Nomenclature

1.6.1 Directions

The front side (the south side) of the Branch Davidian complex is herein called the White Side. The backside (north side) is called the Black Side, while the right side (east side) and the left side (west side) are called the Red Side and the Green Side, respectively. See the aerial photo of the Branch Davidian complex in Figure 1.1 reproduced from the report of Wetherington³.



Figure 1.1 The Branch Davidian complex color-coding. Reproduced from Wetherington³.

1.6.2 Flashover/full fire involvement

The term flashover is used in several places in this report. It denotes the transfer of a fire from a small event limited by the amount of combustible gases available in a fire compartment, to being much hotter and limited by the amount of oxygen available. This rapid transfer occurs when the supply of combustible gases is high enough to consume the available oxygen. Thus, all things being equal, it takes longer for a fire to go from fuel controlled to ventilation control, i.e. to reach flashover, in a well-ventilated compartment. A well-ventilated compartment has, in general, large openings or is exposed to external wind pressures.

At flashover, the overall temperature in the entire fire compartment rises and all surfaces exposed to the fire start to give off combustible fumes, i.e. full fire involvement. All the fumes do not burn inside the compartment, but instead emerge through the compartment openings and burn in flames outside. If the openings lead to other internal spaces, the flames may travel along the ceiling and rapidly spread the fire. Before flashover the fire is localized to a room and there is no immediate risk for fire spread to adjacent rooms. After flashover, flames emerge out of the room of origin and can spread the fire rapidly inside or along facades of the building. Smoke is also produced in large quantities and



is, in this stage of a fire, very toxic as the combustion occurs with limited supply of oxygen.

2 Fire development

2.1 Building structure

My assessment of the Branch Davidian complex structure is based on the work of OSC expert Walt Wetherington who has reviewed the physical evidence related to the fire. I have also independently reviewed photos and videos of the fire to confirm his findings.

Below is a summary of Wetherington's findings, which are relevant to my analysis.

The roof was constructed with 3/8" plywood laid over home made trusses. The roof was covered with roofing felt # 15 STD. The roofing felt was then covered with two types of material, each on a different part of the roof. One section was covered with roll asphalt composition material and the other with fiberglass shingles with an asphalt base.

With the exceptions of the cafeteria and the second and third floors of the towers, the interior wall surfaces were of 1/2" non-combustible drywall, also referred to as sheetrock (gypsum plasterboard). Drywall interior claddings on the first and second floors can be seen in FBI photographs taken from ground level on the White Side of the Green/White tower, see e.g. Figure 2.1.



Figure 2.1 FBI ground photo of Green/White tower. The front wall was covered on the external side with wood panels and on the inside of first two floors with drywall (gypsum boards). The tower second and third floor walls had no internal claddings.

There were no doors to the rooms on the second floor.

The exterior walls were covered with two types of material, each on a different part of the exterior wall. The first type T1-11 panels (1/2" plywood) covered the entire structure except the walls of the cafeteria Black Side and the tower over the concrete



bunker. These were covered only with thin wooden exterior boards, approximately 3/8" to 1/2" thick. They had no interior linings.

In summary, the building did not comply with building codes for facilities accommodating many people, as many of the known interior wall linings were combustible. However, the building structure, in itself, was no worse in terms of fire safety than many single-dwelling houses. No building code fire regulations apply in most countries for such buildings. The Branch Davidian complex had in principal only two stories and the distances to escape routes were short given that windows could be opened from the inside and used for escape, and large parts of the interior wall surfaces had non-combustible linings of drywall. The structural surfaces of the rest of the building, including the towers and the cafeteria, had combustible linings of wood panels, which are acceptable according to most building fire codes in single-dwelling houses.

Wetherington also agrees with the Government's 1993 fire investigators² who concluded that the Branch Davidian complex was a multi-storied, wood-framed building in an irregular shape, with a ground floor area of approximately 12,500 square feet (=1125 m²) and that the building appeared to have been constructed haphazardly over a period of time, with no attention to existing building codes or fire codes. Used lumber had been employed in construction.

2.2 Fuel load

Evidence of flammable liquids of various kinds were found at many places throughout the building and on clothes of the people who escaped the fire. Wetherington³ reports that heavy petroleum was found in the Red/White corner, kerosene, mixed kerosene/gasoline, and gasoline in the chapel area, and finally a sample containing gasoline was found in the kitchen/cafeteria area. Empty fuel containers have also been found at numerous locations. The remains of combustible and easily ignitable materials such as hay and mattresses etc. were also retrieved from the fire debris.

Where fires developed, the building internal surfaces, walls, ceilings and floor coverings were of wood products with fire properties similar to soft wood panels. These types of products ignite within a few minutes when exposed to flames, and release large amounts of energy. See Annex C for detailed information. Thus, any fire started in places of the Branch Davidian complex with combustible surface linings could develop rapidly and spread throughout the structure.

2.3 Chronology of pictoral evidence

Time is based on the FLIR video camera time, which was calibrated with official time (ref. 1). The CBC video tape is given in Eastern Daylight Time and is corrected to the official time by subtracting 1 hr and adding 19 s for Central time.

The FBI aerial photos were taken from an airplane circling the Branch Davidian complex¹. Several series of photos were taken. In this report only series 7 have been used. These photos are 7-1 through 7-36. Figure 2.2 shows the airplane



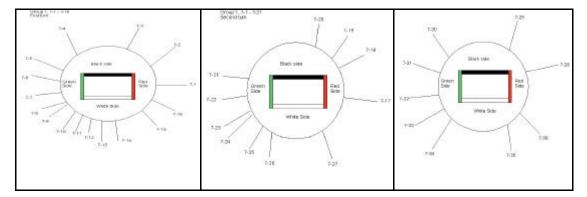


Figure 2.2 Position of airplane in relation to the Branch Davidian complex when taking the aerial photos numbered 7-1 to 7-36.

positions in three circles when the photos were taken. The positions are obtained by observing the visual angles of the photos. There are no times recorded on the FBI photos. Estimates of time are obtained by comparisons with events shown on the FLIR tapes.

The FBI ground photos are, when possible, timed based on observed CEV positions on the FLIR tapes or on CBC broadcasting sequences.

2.4 Fire events

Fires were initially started in at least three locations. Events of these three fires are reported in separate sections below. Figure 2.3 taken from the Final Report of Walter Wetherington³ shows the positions of these fires. I agree with Mr. Wetherington's conclusions concerning the points of origin of the Branch Davidian fire and use his diagram here for illustration purposes.



Figure 2.3 The fire started at three separate locations denoted Fire A, B and C, respectively.



In Figure 2.4 FLIR images and aerial photos are shown side by side at approximately equal times for comparison. The images and the photos are taken from two separate airplanes circling independently above the Branch Davidian complex. With the FLIR, hot surfaces can be detected through the smoke. Hot smoke can also be detected when it leaves the building but before it has been diluted with cool fresh air and adjusted to ambient temperature.



Figure 2.4 FLIR images and aerial photos taken at approximately the same times.

Fires started and continued in at least three locations. Presented below are events observed from recordings of the FLIR tapes, Canadian Broadcast Company, Waco



television stations, aerial photos, and ground photos. These events are in chronicle order for each of the three fires, A, B, and C.

2.4.1 Fire A The stage at the rear of the chapel

Fire A started under the catwalk near the stage at the rear of the chapel. The OSC experts Klasén and Madsen⁴ detected a faint heat image on the original FLIR tape at 12:04:23 at the eave of the collapsed catwalk roof. An indication of a temperature rise at the same location was derived by a detailed numerical analysis of pixels of the FLIR imagery by Klasén and Madsen⁴. This temperature rise on the catwalk roof occurs at 12:04:51. The third (blue) curve in Figure 2.5 plotted at 12:04:51 shows a slight temperature rise at a position where the temperature rise later on at 12:07:02 (cyan line) becomes evident, while the curve plotted before at 12:02:43 (green line) shows no heat increase.

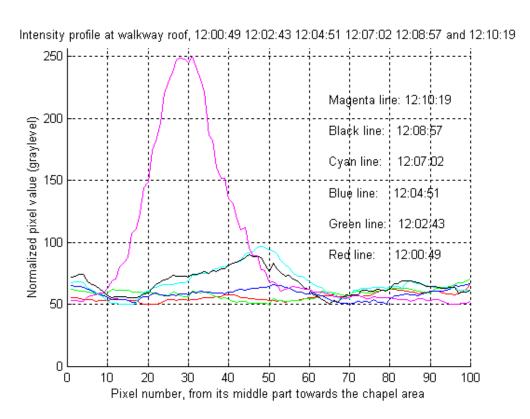


Figure 2.5 Temperature along the eave of the damage catwalk above the gym and stage, cf. Figure 2.7 plotted at various times. The temperatures are obtained by numerical analysis of the FLIR tape. The blue curve shows the first indication of an onset of a temperature rise.

A second heat image was discovered at the eave of the collapsed catwalk roof on the FLIR tape at 12:06:13⁴.

An FBI agent took a ground photo from the Black Side, Figure 2.6 between 12:09:10 and 12:10:21 showing the fire developing in the damaged building under the collapsed catwalk roof. The time range was determined by comparisons with FLIR recordings. A CEV, which left the gym area at about 12:09:10, cannot be detected on the photo and a heated plume emerging outside the gym occurs on the FLIR at 12:10:21. The fire



started further into the building, in the stage area, and was driven by the wind towards the Black Side.



Figure 2.6 FBI Ground photo between 12:09:10 and 12:10:21. Early phase of fire under the collapsed catwalk roof near the stage area.

Heat images in the area of the fallen catwalk quickly develop into intense flaming and were also detected on the FLIR imagery at 12:10:21, see Figure 2.7.



Figure 2.7 FLIR image from 12:10:22. A strong heat image started to appear at the eaves of the collapsed catwalk at 12:10:21. It developed quickly into intense flaming.



The aerial photo where flames are seen was taken about 12:11 p.m., see Figure 2.8.

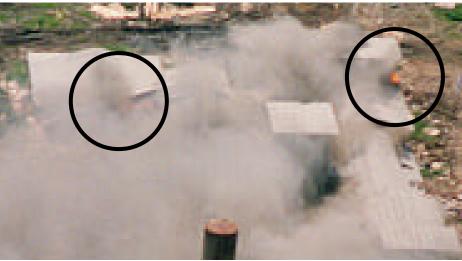


Photo 7-6

Figure 2.8 Aerial photo from approximately 12:11 p.m. First sighting of flames on aerial photos at collapsed catwalk roof. Flames are also seen at the Red/White corner.

Fire A then burnt intensively and generated large amounts of black smoke when the asphalt of the roof covering got involved. The wind, however, hampered the fire from spreading to the rest of the complex, and not until a rather later stage did it merge with fire C, which started in the Red/White tower, see Figure 2.9.



Photo 7-36

Figure 2.9 Aerial photo from approximately 12:16 p.m. Fire A merges with fire B.

Table 2.1 summarizes the main events of Fire A.



Table 2.1 Summary of observations of Fire A at the chapel/stage a	observations of Fire A at the chapel/stage area
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Time	Media	Event
12:04:23	FLIR	A first faint image of heating is detected on the FLIR tape,
		see Ref. 4.
12:04:51	FLIR	Heating starts of catwalk roof eave according to numerical
		analysis of FLIR images (Ref. 4), see diagram in Figure 2.5.
12:06:13	FLIR	A second faint image of heating is detected on the FLIR tape,
		see Ref. 4.
12:09:10 to	Ground	Fires in debris under catwalk, see Figure 2.6.
12:10:21	photo	
12:10:21	FLIR	Intense flaming starts to develop at the collapsed gym roof,
		see Figure 2.7.
12:11	Aerial	First aerial photo sighting of flames at catwalk roof, see
	photo	Figure 2.8.
12:16	Aerial	Fire merges with the fire which started in the Red/White
	photo	tower, see Figure 2.9.

2.4.2 Fire B The cafeteria/kitchen

Fire B started in the cafeteria/kitchen. It was first detected by the FLIR at 12:08:10, see Figure 2.10.



Figure 2.10 FLIR at 12:08:10. The first sighting of fire on the cafeteria wall.

Shortly afterwards at 12:08:11 white smoke over the cafeteria roof came in sight in the CBC TV sequence. The smoke peaked after about a minute and then the intensity seems to go down, see Figure 2.11.





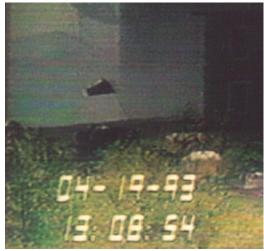


Figure 2.11 CBC at 12:08:24 and at 12:09:13. White smoke coming out from the rear of cafeteria. (For correction of time, see Section 2.3.)

A series of ground photos were taken by the FBI some time between 12:08:10 and 12:08:58, see Figure 2.12. These photos show flames penetrating through the Black Side wall of the cafeteria due to a pressure rise in the early stage of the fire, see Section 3.1.2 and Appendix D. On the right photo of Figure 2.12, flames are seen on both sides of the cafeteria Black Side outer door.



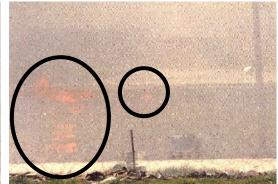


Figure 2.12 FBI ground photos from the Black Side at 12:08:10 to 12:08:58. Flames penetrating through the Black Side wall of cafeteria are circled.

The first aerial photo showing flames of the cafeteria fire was taken at about 12:10:40, see Figure 2.13.





Photo 7-4

Figure 2.13 Aerial photo 12:10:40. First aerial sighting of flames outside the building at the cafeteria Black Side wall.

The flaming on the Black Side of the cafeteria increases and shortly before 12:12:25 black smoke starts to develop as the cafeteria roof ignites at the Black Side eave near the center tower, see Figure 2.14.



Photo 7-18

Figure 2.14 Aerial photo 12:12:25. The cafeteria roof has ignited and the smoke turns black.

At about 12:14 p.m. the cafeteria roof burns through, see the two consecutive photos of Figure 2.15.







Photo 7-26

Photo 7-27

Figure 2.15 Aerial photos at about 12:14 p.m. The cafeteria roof burns intensively on the left photo. On the right photo the roof has burnt through and the roof rafters are visible.

Table 2.2 summarizes the main events of Fire B.

Table 2.2 Summary of observations of Fire B at the cafeteria/kitchen area.

Time	Media	Event
12:08:10	FLIR	First heat image on Black Side wall, see Figure 2.10.
12:08:10 to	Ground	Flames coming through Black Side wall, see Figure 2.12.
12:08:58	photos	
12:08:11	CBC	First sighting of white smoke streaming out from rear of
		cafeteria, see Figure 2.11.
12:08:26	FLIR	Two heat images on Black Side wall.
12:10:40	Aerial	First sighting of flames on aerial photo, see Figure 2.13.
	photo	
App.	Aerial	Red Side of cafeteria roof starts to burn, see Figure 2.14.
12:12:00	photo	
App.	Aerial	Red Side of cafeteria roof burns through, see Figure 2.15.
12:13:55	photos	

2.4.3 Fire C in the Red/White tower

Fire C started on the second floor of the Red/White tower. It was first seen by the FLIR tape at 12:07:41, in the window of the White Side and then ten seconds later on the Red Side at 12:07:51. See Figure 2.16 and Figure 2.17, respectively.





Figure 2.16 FLIR image 12:07:41. The first image of hot air is coming from the Red/White tower (circled).



Figure 2.17 FLIR image 12:07:51. The first heat image in the second floor Red Side window of the Red/White tower (circled).

Heat images caused by conduction through the outer wall appear on the FLIR imagery at 12:09:09. Shortly thereafter at 12:09:25, see Figure 2.18, heat images are discovered in the second floor window to the left of the tower.





Figure 2.18 FLIR image 12:09:25. A bright heat image in the second floor window immediately to the left of the tower. Heat images also due to heat conducted through second floor tower wall. The wood studs appear as cooler (darker) than the fields between.

The first flames are seen on the CBC TV-footage at 12:09:42, see Figure 2.19. These flames appear intermittently depending on the gusty wind and appear alternatively from the White Side and the Red Side of the tower.



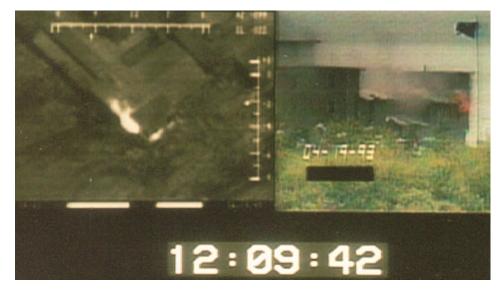


Figure 2.19 Simultaneous FLIR and TV-footage at 12:09:42. First flames emerging from the Red/White tower.

The first aerial photo showing flames in the Red/White tower was taken around 12:10:20, see Figure 2.20. The time estimate is based on the position of the CEV seen in lower left corner of the picture.



Photo 7-1

Figure 2.20 Aerial photo around 12:10:20. The first sighting of flames in the Red/White on aerial photos are seen in the second floor window.

Smoke starts to emerge at 12:13:49 from the first floor on the White Side. The intense flow continues for about three minutes, as shown in Figure 2.21.





Figure 2.21 TV-footage at 12:13:49. Smoke belches out at the White Side of the between 12:13:49 and 12:16:50. (For correction of time, see Section 2.3).

At about 12:16 p.m. the Red/White tower walls start to burn through, see Figure 2.9.

Table 2.3 summarizes the main events of Fire C.

Table 2.3 Summary of observations of Fire C in the Red/White tower

Time	Media	Event
12:07:41	FLIR	A heat image is first seen in the front second floor window
		of the right tower. No increase in pixel intensity could be
		detected on the White Side wall on the Red/White tower
		previous to this time. See Figure 2.16.
12:07:51	FLIR	A heat image is seen in the Red Side window of the second
		floor of the Red/White tower. See Figure 2.17.
12:09:09	FLIR	Heat images on the outside White Side tower wall.
12:09:25	FLIR	Heat images in the second floor window immediately to
		the left of the tower. See Figure 2.18.
12:09:42	CBC	Flames begin to emerge at second floor White Side, see
		Figure 2.19. Flames continue at a slowly increasing
		intensity to emerge alternatively on the White and Red
		Sides depending on the wind direction, see Figure 3.8
12:10:20	Aerial	First aerial photo sighting of flames on White Side of the
	photo	tower, see Figure 2.20.
12:13:49 to	CBC	Smoke belches out on the White Side, see Figure 2.21.
12:16:50		
12:16	Aerial	Red/White tower walls burn through, see Figure 2.9.
	photo	
12:25:00	CBC	Red/White tower collapses.



3 Analysis of the fire development

3.1 General

Fires were started at several positions in the complex. Three separate fires developed into large fires that eventually burnt down the whole Branch Davidian complex. The remaining fires extinguished themselves when the liquid ignition sources were consumed. As can be seen in Figure 3.1 hot gases leave the building at many places, indicating that separate fires have been started at several locations. There are many heat images on the second floor green end of the main building. These fires did not develop and did not get involved again until very late in the fire, around 12:20 p.m. when fire spread from the cafeteria.

Large parts of the building, including the chapel and two stories of the main building, had interior linings of non-combustible drywall (gypsum boards). That is an important reason why the fire did not spread faster than it actually did. Drywall resists intensive fire exposure for 15 to 20 minutes. As a matter of fact the fire spread to a very large extent via facades and roof constructions. The roof coverings contained asphalt, which ignited easily and burnt intensively.



Figure 3.1 FLIR image 12:10:19. Hot gases are indicated in several places of the second floor and along the Black Side of the cafeteria.

3.1.1 Fire A at the stage in the rear of the chapel

The first faintly visible heat image of the fire at the stage in the rear of the chapel was discovered on the FLIR at 12:04:23, and the first indication of fire derived from an numerical analysis of the FLIR pixels occurred at 12:04:51, see Section 2.4.1. The heat signatures are from smoke and heat that had traveled in the wind direction from the stage area. In order to be detected by the FLIR, the fire in the stage area must have reached certain intensity yielding smoke at the eave of the catwalk roof that was sufficiently hot and dense to be detected by the FLIR. However, as the rate of development in the early stage of a fire can vary, estimates of when this fire may have started are difficult to make. Given the fire was started with accelerants, it is reasonable to assume that this fire started shortly before 12:04 p.m.



The fire at that early phase developed in the debris of the damaged gymnasium. At about 12:10 p.m. the roof covering on the catwalk ignited and burnt vigorously producing a large amount of black smoke, see Figure 3.2 and Figure 3.3.



Photo 7-7

Figure 3.2 Aerial photo at about 12:10 p.m. The fire in the debris of the damaged gym developed quickly and ignited the roof covering which burnt and produced large amounts of black smoke.



Figure 3.3 FBI ground photo from the Red/Black corner. The fire in the Red/White tower and the fire at the stage at the rear of the chapel are two separate fires.

The fire spread slowly against the wind towards the chapel and did not merge with the fire, which started at the Red/White tower (Fire C) until about 12:16 p.m., see Figure 2.9.

3.1.2 Fire B in the cafeteria/kitchen area

The first indications of a fire in the cafeteria/kitchen are the hot spots (flames) detected by the FLIR at 12:08:10 (Figure 2.10) and 12:08:26 on the Black Side wall. Heat penetration tests, c.f. Annex B, indicate that it takes about 3 minutes for heat to



penetrate by conduction 1/2" of plywood and create a temperature rise of 10°C on the side unexposed to fire. The cafeteria wall was only 3/8" to 1/2" thick, see Section 2.1.

The FLIR image at 12:08:10 (Figure 2.10) shows no sign of a temperature rise in the wall surface. It shows only flames penetrating through the wall, cf. Figure 2.12. This indicates that the heating of the larger parts cafeteria Black Side wall must have started later than 12:05. On the other hand, the FLIR imagery of 12:10:22 (Figure 2.7) shows heat images on all the boarded windows on the Black Side wall of the cafeteria. This indicates that flashover or full fire involvement has occurred two to three minutes earlier, i.e. about 12:08 p.m. or at the same time as flames were seen penetrating through the Black Side wall.

The large amounts liquid fuel ignited inside the cafeteria caused the flames evident in the FBI ground photos of Figure 2.12. The intense burning that followed the ignition of accelerants and other easily ignitable combustibles raised the pressure inside the cafeteria and pressed fuel vapor out through the thin and poor wall construction, see Annex D. No flames occurred around the door presumably because it was blocked to prevent the FBI from coming in.

The cafeteria was more or less a closed space. As a result an overpressure was generated in the cafeteria when the temperature of the internal gas mass rose due to the fire. The windows were boarded and only two doors existed internally. To be clear there was no explosion. However, the pressure rose by approximately the same magnitude as the wind pressure or more, which was enough to force fuel vapor through the poor wall construction. At the time the photos of Figure 2.12 were taken, the Black Side wall of the cafeteria had already been exposed to fire for some time and had become damaged and more permeable. Figure 3.4 shows the White Side



Figure 3.4 FBI ground photo. The Green/White tower on fire. Similar holes as shown here on the third floor allowed flames to emerge out of the cafeteria Black Side wall in the very early stage of the fire, cf. Figure 2.12.

of tower in a late stage of the fire. Like the cafeteria wall, the third floor of the Green/White tower have no interior sheet covering. This is evident as the flames are



seen through the poor construction. If the wind pressure had been in the other direction flames would have emerged out these holes as they did at the cafeteria wall in the beginning of the fire at around 12:08 p.m. For a detailed analysis of the pressure rise see Appendix D.

After the expansion of the gas mass inside the cafeteria (lasting 30 seconds or less), the fire intensity inside the cafeteria went down as the liquid accelerants were consumed and the oxygen concentration was reduced. The fire, however, continued to burn inside the cafeteria and at the eave of the roof. It appears that the board covering the window to the left of the cafeteria door fell down or was opened by the gas pressure allowing the hot fire gases to come out. This had a profound effect on the fire conditions in the cafeteria. Note in Figure 3.5 that the boarding of the window to the left of the door is weaker than the boarding of the window to right of the door. The patch in at the upper right corner of that boarding is not fastened in its lower left corner.



Figure 3.5 FBI ground photo from the Black Side of the cafeteria. The board covering of the window to the left of the door appears weak and may have fallen when liquid fuel was ignited and the interior pressure increased.

At around 12:12 p.m. the fire spreads to the roof and the smoke turns black from the cafeteria roof area, see behind the center tower in Figure 3.6. See also Figure 2.14. The black smoke comes from the burning asphalt of the roof covering.







Photo 7-16

Photo 7-17

Figure 3.6 Aerial photos at around 12:12 p.m. The smoke from the cafeteria area turns black when the roof covering starts to burn.

The cafeteria roof consisted of 3/8" plywood sheets covered with roof felt and rolled asphalt or asphalt shingles, which did not burn through during 15 minutes of intense fire exposure, cf. Annex B. However, Cone Calorimeter tests with the 3/8" plywood showed that the specimens were consumed after about 7 minutes, cf. Annex C. The mounting of the specimen with a backing material and better access to air and oxygen in the Cone Calorimeter test, in comparison to the furnace tests explains this discrepancy in time between the two tests methods. In the Branch Davidian fire the roof burnt from two sides from about 12:12 p.m., which of course reduces the burn through time. Thus, the burn through time would indicate that a ceiling fire was developed in the cafeteria already at about 7 to 15 minutes before the roof burnt through at 12:14 p.m., i.e. between 11:59 and 12:07 p.m. These estimates are of course very rough and uncertain, as they depend on the actual quality of the plywood. It is just noted that the time of ignition maybe put further back in time than the conservative time concluded below.

3.1.3 Fire C in the Red/White tower

Fire C is first seen on the FLIR imagery at 12:07:41 in the second floor window of the White Side of the Red/White tower. During the aircraft's immediately proceeding circle of the compound, the FLIR captured the Red Side of the tower until 12:06:14 and the Black Side of the tower until 12:06:41. The Black Side of the tower is downwind and even a relatively small fire in the tower at 12:06:41 would have been discovered by the FLIR by its hot smoke. From this time and the quick development that subsequently occurs, I conclude that the fire in the Red/White tower must have started sometime between 12:06:30 and 12:07:30.

Flames were first seen from the second floor window of the Red/White tower, White Side at 12:09:42. This was captured by the news media, see Figure 2.19. The ignition source was powerful and flames emerged out of the second floor windows both on the Red and the White Sides. The wind, however, cooled the fire, and temperatures therefore did not become as high as they otherwise would have been.

It has been claimed that the fire may have started by lanterns, tipped over when a CEV hit the Red/White corner of the complex shortly before the fire started. The lanterns in question contain at most about one liter of liquid fuel. They are of a robust construction and are unlikely, even if they fall to the floor, to quickly let the fuel out and start an intense fire in the Red/White tower.



The tower walls were made of wood studs covered only with 3/8" to 1/2" thick external wood boards. These burn through in about 10 to 15 minutes at the relatively low irradiance level of 25 kW/m², see the Cone Calorimeter tests reported in Annex C. The first hole in the exterior walls, limited to an area near a presumable ignition source, is observed at around 12:15 pm. A total collapse did not occur until 12:25.

The wind cooled the fire in the early stage and therefore it took a rather long time for high temperatures to develop and full involvement or flashover to occur. In general after flashover, the fire becomes very hot and so much combustible gas is produced inside the compartment in relation to the ventilation, that these gases cannot burn inside the compartment, see also Section 1.6.2. Thus, as the time to flashover was extended due to the wind, the fire development was delayed and the fire did not spread into the second floor corridor in the center of the building until a relatively late stage. Ultimately, the fire spread with the wind moving towards the chapel and igniting its roof at about 12:14 p.m. Note in Figure 3.7 how the smoke at the Red/White tower has turned black, as the asphalt of the chapel roof covering has started to burn.



Photo 7-28

Figure 3.7 Aerial photo at 12:14:10. The fire in the Red/White tower spreads with the wind and ignites the chapel roof.

The fire inside the chapel developed slowly. Even by 12:16 p.m. there are no flames from the Red Side windows, and the roof at that end has not yet ignited, see Figure 2.9.

3.2 Conclusion

The occupants of the Branch Davidian complex started numerous fires using liquid fuels and other easily ignitable combustibles. Three of those fires developed into sustained burning fires and each started within a short period of time, i.e.

•	Fire A	A in	the	stage	area	shortly	y before

Fire B in the cafeteria between

• Fire C in the Red/White tower between

12:04 p.m.

12:05 and 12:06 p.m.

12:06:30 and 12:07:30 p.m.



The above ignition times are supported by the FLIR tapes, photos, videos and testing performed by SP, and are my best estimate given that fires in the early stage can develop very differently depending type of fuel, fuel configuration and ventilation.

It is beyond credibility that the three fires could have started in a similar fashion, yet independent of one another. These fires must therefore have been started deliberately and I have seen no evidence or indications that they could have been started by anyone but the occupants.

3.3 Wind effects

The wind can have a dramatic effect on the development of a fire and may even extinguish a fire. Depending upon the circumstances, the wind can either speed up or delay fire development. In theory, the highest temperatures in a fire, or any combustion process, are obtained when the relation between the amounts of fuel and oxygen (or air) is optimal. This is called stoichiometric combustion. In general, too much air cools a fire, as the excess air cannot participate in the combustion process. In practice roof vents are often installed in industrial buildings to permit hot fire gases to leave a building and be replaced by cool fresh air. It is also common practice for fire fighters to punch holes in roofs to cool off a fire and facilitate extinguishments.

However, after flashover, when not enough air is available inside the fire compartment to maintain combustion of the gases, additional ventilation will increase the combustion rate inside the room and the temperature will continue to increase. Winds can also speed wood fires when surface glowing has developed or on fires situated deep inside a fuel bed where fresh air otherwise does not reach.

Another basic fire principal is that fires spread with the flames, i.e. upwards or with the wind. A bushfire spreads rapidly with the wind because the flames bend over allowing the fire to spread horizontally. In general, a room fire spreads slowly until the flames hit the ceiling and start to travel horizontally along the ceiling, often along a wall. If the ceiling or the wall is combustible it will contribute to the burning and the intensity of the fire can increase rapidly.

In the case of the Branch Davidian fire, the wind both sped up and retarded the fire development as discussed below. On April 19, 1993, the wind was strong coming from the direction of the Red/White corner. At 6.02 a.m. the wind speed was reported to be 20 kt (10 m/s) with gusts up to 28 kt (14 m/s)⁴.

Fire A at the stage at the rear of the chapel was influenced by the wind as the fire in the debris of the damaged building was accelerated by the wind. However, the wind retarded the spread of the fire towards the chapel and the rest of the complex.

Fire B in the cafeteria/kitchen area was not as sensitive to the wind in the early stage of the fire as there was no large opening on the leeward side of the building in the very beginning of the fire. The wind, however, did cause an under-pressure on the leeward side, i.e. the outside of Black Side wall of the cafeteria. The under-pressure in combination with the inside overpressure due to rapid fire development, see Section 2.4.2, caused the fire gases and flames to penetrate through the Black Side wall, see Figure 2.12.



In a later stage of the fire between 12:08 and 12:45 p.m., when an opening was established on the Black Side wall of the cafeteria, the wind created a draft through the building from the White Side to the Black Side. This forced flames and heat towards the Black Side of the complex, and kept the White Side relatively free from smoke and hot gases.

Fire C in the Red/White tower was started using large amounts of liquid fuels. Flames emerged at 12:09:42 from the second floor White Side window of the tower. At this early stage of the fire the wind forced the flames of the mainly liquid fire out the tower windows. Flames then continued to emerge out the windows alternatively from the White Side and the Red Side, see Figure 3.8. Without the wind, the flames would have stayed at one position heating and igniting the ceiling and the walls within a couple of minutes.





7-16

7-17

Figure 3.8 Aerial photos at 12:12:30. Two consecutive photos. The flames appear alternatively from the white and the Red Side tower windows. Intensive flames in the chapel.

We know from Cone Calorimeter tests, see annex C, that it takes 30 seconds to two minutes of continuous heating to ignite wooden linings similar to those in the Branch Davidian complex. The wind caused the flame inside the second floor room of the Red/White tower to move around heating some parts of the room for a short time and then allowing them to cool. The wind therefore cooled the room and slowed the development of a hot gas layer under the ceiling. Without the wind, the walls and ceilings of this room would have ignited much earlier and the fire intensity would have increased more rapidly than actually occurred. Note that the walls and ceilings have a very large surface that can burn. Wood does not burn at the same rate as liquid fuels, but the wooden structure constitutes the major part of the fuel load of this fire.

In conclusion, the Red/White tower would have burnt down faster without the strong wind. Other fires were also started in the complex, which were extinguished by themselves. The strong wind may have contributed to this as well.

4 Possibilities of escape

Fire B in the cafeteria/kitchen area is definitely the most critical for the safety of the occupants of the Branch Davidian complex. Most of the victims were found in the concrete bunker and immediately in front of it. From that position there are four ways to escape, through the cafeteria, up the stairs through the second floor, through the



windows on the first floor White Side, and through the holes made by a CEV on the White Side.

One or more fires were started in the cafeteria and quickly filled that space with smoke blocking any escape. The staircase was involved early in the fire by 12:10:19. See the FLIR image shown in Figure 4.1. Thus this route may have been blocked in an early stage as well. Two cans of fuel with holes were found in this area after the fire.



Figure 4.1 FLIR image 12:10:19. Hot gases or flames are indicated in the windows of the staircase and of the adjacent room.

Whether escape was possible through the White Side windows and the CEV holes depends on where fires were started in relation to the positions of the occupants. No fire was likely started immediately in front of the bunker opening or towards the White Side of that opening, as it took a very long time before the roof above the kitchen to burn through, see Figure 2.9. This may, however, been driven by the fact that the ceiling in that part of the building was covered with noncombustible sheetrock boards.

A fully developed fire did not probably develop in the bunker itself in an early stage. This would have caused flames and hot gases to leave out through its only opening which would have ignited the ceiling outside the bunker opening. This seems not to have occurred, as no heat sources on the roof at the White Side of the bunker were detected on the FLIR imagery, nor did it burn through in an early stage. A minor fire may, however, have been started in the bunker, which could have blocked the entrance and released enough toxic gases to cause lethal conditions in the confined area of the bunker. The hole in the bunker ceiling created by spalling, see chapter 6, could not have been an escape point for fire gases, as spalling does not occur until late in a fire when very high temperatures have developed.

Those who were outside the bunker must have been aware of the fire burning in the cafeteria and could have exited through the many holes on the White Side. In fact, nobody left the building from the first floor of the White Side. Those four who escaped the fire from the White Side did so at a rather late stage from the second floor of the complex. The staircase from the cafeteria was blocked by fire very early so these people must have either been on the second floor when the fire started or entered via another



staircase. Figure 4.2 from the final report of Walter Wetherington³ shows generally where nine Davidians escaped the fire.

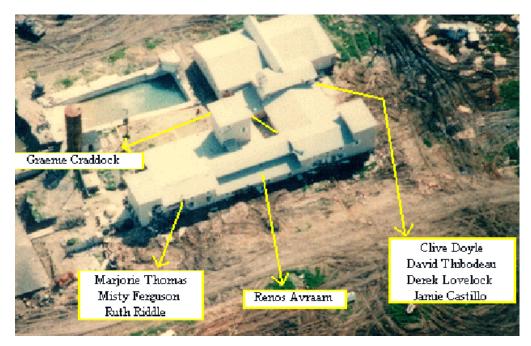


Figure 4.2 Davidians' escape routes from fire. This drawing is reproduced from the final report of Walter Wetherington³.

4.1 Conclusion

In summary, I believe that all the occupants could have left the building if they so wanted, except possibly those residing in the bunker or those being forced to stay.

5 Possibilities of fire fighting and rescuing

The discussion below assumes that fire fighters could respond without risk of being killed or repelled by Branch Davidian gunfire. My knowledge and experience of fire extinguishment is based on the activities I follow at the Department of Fire Technology of SP, where we daily conduct extinguishing tests and where we have several experts on fire extinguishment procedures, which I have consulted. My opinion in this regard is based on theoretical knowledge and not on practical experience of fire fighting.

Although the fire was started with lots of accelerants, there are circumstances that would facilitate fire fighting in an early stage. The building was easy to access as it had, in principal only two stories and no long internal access routes. Moreover, fire gases could efficiently be evacuated due to the wind and the many openings, including those created by the CEVs. Therefore, the fire would have been relatively easy to knock down and control in an early stage, when the combustible structure and solid items are still cool except for thin burning surface layers, and no glowing, deep-seated, fire pockets have yet formed. I want to stress that to fight the fire successfully it has to be in very early stage requiring equipment and personal on site, adjacent to the building, when the fire broke out.



In particular if the rescue operation were directed towards the central area and the bunker, additional time could have been given for the people to escape. Even those in the bunker could have been helped unless a fire had been started inside the bunker as well.

Fire A at the stage at the rear of the chapel would be difficult to fight, but it is, on the other hand, of rather limited importance for the safety of the occupants. It could have been attacked with success from the Black Side when it was very small and before the smoke became too dense. It could of course also have been attacked via the chapel, but the fire was not directly accessible that way.

Fire B in the cafeteria/kitchen area is relatively difficult to fight, as it is situated inside the building and not directly accessible from the windward direction. However, I still believe a successful fire fighting and rescuing operation could have been carried out if started early enough, that is, before the wooden structure and other solid combustible items had ignited and before the heat had penetrated deeply into the burning objects and no glowing was formed. I would roughly estimate the available time for a successful rescue operation is up until 12:09 p.m. That is about two and a half minutes after flames were photographed on the back side (Black Side) of the cafeteria. The amount of high quality modern dry powder needed to knock down the fire in the cafeteria in an early stage is in the order of 50 kg (110 lb). This would give about 140 g/m³, as the volume of the cafeteria is 370 m³ (4000 ft²). This value is well on the safe side to knock down the fire and if followed by limited amounts of water from a fire truck the fire could probably have been extinguished. Dry powders are in general not toxic.

I believe that Fire C in the white/red corner could have been extinguished with about the same amount of dry chemical powder if applied within a one or two minutes after flames were seen outside the compartment, i.e. around 12:11p.m, when the fire had not yet spread to the interior of the building. The extinguishing media could have been applied from the outside with suitable equipment mounted on a specialized vehicles, e.g. airport fire service trucks using mixtures of dry chemical powder and gaseous extinguishing media like halon 1211. Halon 1211 is an agent often used in e.g. portable fire extinguishers.

5.1 Conclusion

At least theoretically the fire could have been successfully fought if conducted within a few minutes after the fires were ignited and discovered. The response, however, would have to be direct and immediate, that is, equipment and personnel ready on scene, adjacent to the complex, and with knowledge of the layout of the Branch Davidian complex and the location of people. The Office of Special Counsel has advised me that during the early stages of the fire Davidians were shooting at and repelling outsiders. As a result, firefighters could not safely approach the complex until after 12:30 p.m. Under these circumstances the fire would have progressed too far by 12:30 p.m. to have been controlled or stopped by any means.

6 Comments on center bunker damages

I understand that some experts claim that the hole discovered in the center bunker was made by a "demolition charge" that went off on the ceiling. See Figure 6.1





Figure 6.1 FBI photo. The hole in the concrete ceiling slab of the bunker. Note the poor concrete quality.

I have carefully studied pictures that I have received from the OSC and I have made the following observations.

1. From the TV footage of the final demolition of the center bunker and from Figure 6.2 it is evident that the bunker had brick or cinder block walls covered in a thin coat of plaster or cement. This type of wall is very brittle, which is obvious from the TV footage of the demolition. This type of wall can carry gravity loading, but is sensitive to impact loading, for example, from an earthquake or an explosion.



Figure 6.2 FBI photo. Bunker walls were made of plastered cinder blocks.

2. The bunker was constructed in the 1930's and was subject to a fire in 1980. Concrete does in principal not deteriorate over time, but the qualities of cement from the 1930's are inferior to modern qualities. The fire exposure from 1980



may well have given the concrete irrecoverable internal damages that influenced its strength. On April 19, 1993, the bunker was exposed to fire for a long time and the concrete was exposed to intensive heating from above and from below. The temperature in the concrete therefore varied substantially over the thickness, as well as over the plane of the slab. Thus, internal stresses developed when the concrete expanded due to the temperature rise. Stresses also developed due to water steam pressure when the concrete temperature passed the boiling point of water of 100 °C. When the total stresses passed the strength of the concrete, it spalled off smaller or larger pieces. In this case the concrete was of low quality and had been exposed to a previous fire, cf. Figure 6.1 and Figure 6.3.



Figure 6.3 Spalling occurred at several places of the bunker slab due to intense fire exposure from below and from above.

3. Spalling is generally a random phenomenon, but is quite common. Figure 6.4 shows two examples from the literature of spalling of fire exposed concrete structures.







Figure 6.4 Example of spalling of concrete structures exposed to fire found in the literature⁵.

- 4. As can be seen in Figure 6.3 the hole developed near one of the beams. That is a weak point of the slab as it is only reinforced for sagging. The concrete therefore cracked under load at the top surface along the beam while compression developed at the bottom surface.
- 5. The visually shallow concrete coverage of the reinforcement bars, sometimes in a diagonal direction, gives an impression of a non-professional building technique.

6.1 Conclusion

Based on the photos I have seen and the knowledge of the fire that the bunker top slab has been exposed to, I conclude that the hole was caused by spalling which resulted from the intensive heat of the fire.

7 Comments on reports of other investigators

In preparing this report the OSC provided me with several reports by other experts on this same subject matter. In particular I have been asked to consider the reports of the Drs. James G. Quintiere and Fredrick Mowrer, of September 1993¹, and the briefing conducted by Patrick M. Kennedy, October 1999⁶ and his report and declaration of February 2000⁷.

7.1 Quintiere and Mowrer

Quintiere and Mowrer¹ have made a very comprehensive and accurate compilation of the fire events observed mainly from the FLIR video, the CBC television broadcasting, channel 10 of Waco live coverage and 7 rolls of 36 color prints. Most importantly, I do agree with Drs. Quintiere and Mowrer that three separate fires cannot start accidentally at the same time. I agree that the fires inside the Branch Davidian complex were intentionally started.

Quintiere and Mowrer have analyzed these fires using theories that are developed for room fires with "normal" fuel loads and with no wind effects. I do not think such theories apply in this case. The early stage of the Branch Davidian complex fire is



controlled by the accelerants. As a result, the fire develops very quickly in the beginning and then goes down when the liquid fuel is consumed. Contrary to Quintiere and Mowrer's analysis I do not believe it is reasonable to assume that the fires double in a given time.

Moreover, it is not reasonable to apply conventional rules for calculating ventilation rates. The wind effects dominate the buoyancy effect developed by the fire. Therefore, I believe the theoretical base of their considerations of the fire development is weak. Drs. Quintiere and Mowrer contend that the wind had a profound effect on the external fire, but that it did not appear to have had a significant effect on the fire growth within the complex. I do not agree. I believe the strong wind in combination with open windows had a strong effect on the fire development in three ways: several fires were extinguished by the wind, the wind cooled the fires and delayed flashover, and finally the wind prevented the fire to spread against its direction. The wind also had a significant effect on the possibilities for escape and to fight the fire. The wind actually kept the White Side of the building relatively unaffected by the fire for a long time.

7.2 Patrick Kennedy

Patrick Kennedy⁷ claims that the U.S. Government expert investigation of the fire was "fatally flawed." Below I have commented on his key observations relevant to my investigation as outlined in his report under "Overview of Report and Declaration."

A "The government's fire investigation was fatally flawed."

I have reviewed several reports of the government's experts, see Table 1.1, and I have not noticed any important information that has been misused or left out in coming to the main conclusion that the fire was simultaneously and intentionally started at at least three places in the Branch Davidian Complex.

B "The government's fire experts opinions that there were three separate, simultaneous fires and Davidian arson are unreliable."

Based on the FLIR video and photos like the one in Figure 7.1, I am strongly convinced that fires started in at least three separate locations. Mr. Kennedy expressed doubt in using the FLIR recordings as evidence for the fire development. Even without the FLIR imagery it is clear that the fire started in at least three locations.





Photo 7-7

Figure 7.1 Aerial photos approximately 12:10:30 and 12:11:45, respectively.



A fundamental fact is that the first flames were observed on the TV footage at 12:09:42 and the photos in Figure 7.1 were taken only a minute or two afterwards. This cannot happen unless more than one fire was started. Given the wind direction and its strength, a fire could spread neither from the cafeteria nor from the gym area to the Red/White tower in such a short time. If started in the Red/White tower second floor, on the other hand, the fire could not spread to the cafeteria (first floor), as fires do not easily or quickly spread downwards.

Other possibilities could of course be considered, but I cannot see any credible explanation for the fire development other then there has been multiple ignition sources. In particular, none of the means (a) to (h) listed by Kennedy⁷ on page 13 in his report are relevant.

C. "The government's fire experts' opinion that there was Davidian arson ignores potential ignition of the fire by government actions."

Three fires developed very fast in the first phase. That excludes the possibility of small ignition sources. The Branch Davidian complex was carefully surveyed when the fire started and observations were recorded by both conventional means, aerial and ground photos and TV sequences, and video sensitive to infrared radiation (FLIR). The observations from the first indication of a fire until full fire involvement is so short that it could not have happened without the use of accelerants. Moreover, based on the tests reported in Annex A, I concluded that the tested projectiles and the Flash Bang grenade left remains after exposure to the severe fire conditions. Thus had an M651 military round been responsible for a fire inside the compound, it would have been found amidst the fire debris.

D "The government's fire experts' opinion that flammable liquids were intentionally used to accelerate the fire is unreliable."

See above. Also see analysis of physical evidence in Wetherington's report³.

E "Though not relied on by the government's fire experts, purported Davidian statements are unreliable and inconclusive."

No comments. See Davidians statements related in Wetherington's report³.

F "The government's destruction of the fire scene made it impossible to answer the questions left open by the government's inadequate fire investigation."

For my analysis of the fire development, little would probably have been gained by a visit to the fire scene. My analysis is based on pictoral evidence.

G "The government's position that it had no role in the fire-related deaths is erroneous."

As outlined in Chapter 5, I believe the fire could have been fought in an early stage under certain circumstances. Not necessarily by airborne extinguishment with water, but probably more efficiently with dry chemical powder possibly mixed with gaseous extinguishing media. These extinguishing media are very efficient on liquid fires and also on wood fires in an early stage when the heat has not yet penetrated into the wood and no glowing wood fires have yet developed. However, as stated earlier, because the



fire fighters could not safely approach the complex until after 12:30 p.m., it was not possible for them to extinguish this fire.

The demolition of the building had an effect on the fire, in particular fire A, which started at the stage at the rear of the chapel. This fire, however, spread very slowly towards the wind and never became a direct threat to the occupants. Whether the demolition at the center of the building had any influence on the fire in that area is hard to exactly know. No doubt the opening provided a way for escape and it cleared the way from smoke. On the other hand, it could make the circumstances worse for the occupants situated in the wind direction and make the building easier to ignite. The fact is, however, there was no fire near the CEV holes on the White Side until a very stage late of the fire, i.e. after 12:22 p.m.

8 Final conclusions

The assignment of this work is outlined in Section 1.1 and repeated in *italics* below. After having completed this investigation I have come to the following conclusions concerning the listed questions at issue:

1) Determine whether agents of the United States started or contributed to the spread of the fire that killed members of the Branch Davidian group on April 19, 1993;

I see no evidence that agents of the United States started or contributed to the spread of the fire that killed members of the Branch Davidian group on April 19, 1993.

2) Determine whether additional information can be developed concerning the cause and/or point(s) of origin of the fire;

By carefully studying the material provided to me, I have in coorporation with OSC experts Klasén and Madsen⁴, and Wetherington³ improved and widened the information about the fire development. In particular the times and origins of the various fires have been thoroughly investigated.

3) Determine time of ignition for individual fires;

The fire was started in at least three separate locations. The early parts of the fires have been thoroughly investigated and the best possible estimates of the time of initiations of the fires have been determined.

4) Determine whether fire fighters could have controlled or stopped the spread of the fire;

At least theoretically, the fire could have been successfully fought if conducted within a few minutes after the fires were ignited and discovered. The response, however, would have to be direct and immediate, that is, equipment and personnel ready on scene, adjacent to the complex, and with knowledge of the layout of the Branch Davidian complex and the location of people. If applied early enough dry chemical powder backed up with water would be effective to knock down the fires before the heat had penetrated far into the solid combustible items. However, because fire fighters could not safely approach the complex until after 12:30 p.m. due to Davidian gunfire, it was not possible for them to extinguish the fire.



5) Determine whether the Branch Davidians had the opportunity to escape the fire;

The Branch Davidian Complex was a relatively small and low building. Escape routes were short and all the Davidians could therefore have walked away from the fire if they so wanted, except possibly those who were residing in the bunker who could have been trapped by fires started outside the bunker entrance.

6) Determine whether the analyses of Dr. James Quintiere, the U.S. Government's Fire Dynamics Expert and Patrick Kennedy, a Fire Dynamics Expert retained by the Branch Davidians, accurately and completely defined the cause of the fire and its point(s) of origin;

Drs. Quintiere and Mowrer, the U.S. Government's Fire Dynamics experts, reported thoroughly and accurately about the fire. Their theoretical analyses are in some aspects, however, based on wrong assumptions. Patrick Kennedy, a Fire Dynamics expert retained by the Branch Davidians, accused the government of having flawed the fire investigation. I have commented his statements and expressed my deviating opinions.

7) Determine whether heat from the fire affected the structural integrity of the concrete bunker roof;

Based on the photos I have seen and the knowledge of the heat and fire that the bunker top slab has been exposed to, I conclude that the hole was caused by spalling which resulted from the intensive heat of the fire.

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Datum/Date 2000-09-20

10 References

- Quintiere, J., and Mowrer, F., Fire Development Analysis, Mount Carmel Branch Davidian Compound, Waco, Texas, April 19, 1993, submitted September 1993.
- The Government's 1993 Fire Investigation
- Wetherington, W., Final Report concerning the Fire at the Branch Davidian Complex, Waco, Texas, 19 April 1993, prepared for the Office of Special Councel Waco Investigation, August 2000.
- Klasén, L., and Madsen, S., Waco Investigation: Image Analysis and Video Authentication, prepared for the Office of Special Councel Waco Investigation, September 2000.
- Kordina and Meyer-Ottens, "Beton Brandschutz Handbuch", Beton-Verlag, 1981, ISBN 3-7640-0136-4
- Briefing conducted by Patrick Kennedy, CFEI, October 5, 1999.
- Patrick M. Kennedy, Report and declaration, February 29, 2000.



Annex A – Testing of ferret rounds – Bonfire melt testing

Purpose of test 1

To determine what debris, if any, could be recovered of the test specimens after being exposed to severe fire conditions.

2 Customer

The test was performed for Office of Special Counsel ("OSC"), John C. Danforth, St Louis, Missouri, USA.

3 Date of test

The test was carried out on April 26, 2000.

4 **Test specimens**

4.1 Identification and source of test specimens

The following test specimens were delivered to SP by the OSC on March 31, 2000. Four types of objects, two items of each, were received:

Item no	Evidence Label No	Description
1	A00811749	Two (2) levers and caps from expended hand delivered flash bang grenades.
2	A00811748	Two (2) forty millimeter flash bang casings and projectiles fired from a M-79 Grenade Launcher.
3	A00811108	Two (2) forty millimeter Ferret casings, wadding and projectiles of the type used by the FBI at the Branch Davidian complex on April 19, 1993.
4	A00811102	Two (2) forty millimeter XM651E1 casings (military rounds) with spent projectiles of the type used by the FBI at the Branch Davidian complex on April 19, 1993.

4.2 Measured data

No dimensions were measured on the test specimens. Weight before and after test is given under test results.

4.3 **Conditioning**

No conditioning was performed on the test specimens prior to test.



5 Test specifications

The specimens were placed in a wood crib as shown in figure 1.

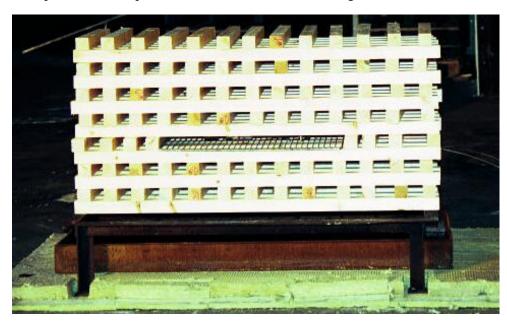


Figure 1 Wood crib on steel grid and container for ignition fuel underneath. The entire set up is placed on a sheet of mineral wool for protection of the floor.

The cribs had the dimensions 45 mm by 45 mm. (The crib used is similar to the crib of size 13A as specified in EN 3-1:1996, enclosure B). One sample of each the four types of products was placed on a metal grid, which was then placed on top of the 3rd layer of 7, see figures 1 and 2.



Figure 2 The specimens were placed inside the wood crib. Item 1 lower/right, item 2 upper/right, item 3 upper/left and item 4 lower/left. (The bags at the sides contain the duplicates of the test samples. The duplicates were removed prior to completion of the wood crib.)



The crib was placed on a steel frame. Under the crib was a container that was filled with 3 litres of heptane (gasoline) to ignite the fire. A thermocouple was placed inside the crib to record temperature.

6 Test procedure

The data logging was started. The heptane in the container was ignited one minute later. The test was terminated one hour after the heptane was ignited.

The temperature near the specimens inside the crib was recorded during the whole test period.

The remains of each test specimen were compared to the duplicates of the test specimens after test.

7 Observations

The wood crib had access to air from all sides including from below and burnt intensively at high temperatures for about one hour.

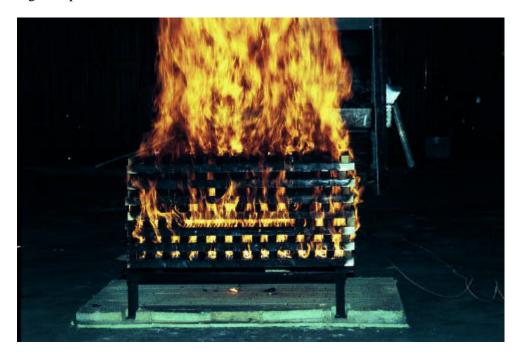


Figure 3 The crib burnt intensively at high temperatures. The specimens were placed inside the crib.

Time (min:s)	Observations
0:00	Start of test
1:00	Ignition of heptane
2:45	Heptane consumed
3:00	Melting plastic dropped down
18:00	The crib collapsed
61:00	The test was terminated



Temperatures above 1000 °C were recorded for a period of 35 minutes, see figure 4.

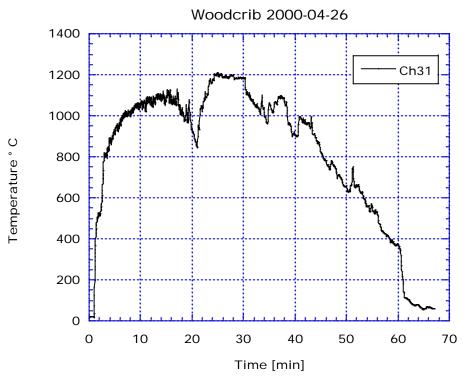


Figure 4 Temperature recorded in the wood crib near the specimen.

If ferret rounds had been shot into the Branch Davidian complex, they would have fallen to the floor. At such a location the temperature during the Branch Davidian complex fire is not likely to have exceeded $1000~^{\circ}$ C.

8 Test results

After the test, the ashes were searched to recover all remaining pieces of the fire-exposed items. Figure 5 to 8 below show pictures of tested and not tested parts. Plastics (organic materials) were completely consumed by the fire. Pieces of aluminum melted, while the handle of item 1 remained more or less in shape, see Figure 5.



Item No	Description	Weight (gram)	
		Before test	After test
1	Lever and cap from expended hand delivered flash bang grenade (<i>Figure 5</i>).	24	26
2 (whole item)	Forty mm flash bang casings and projectiles fired from a M-79 Grenade Launcher (<i>Figure</i> 6).	201	97
2 (casing only)		50	1)
3	Forty mm Ferret casing, wadding and projectile of the type used by the FBI at the Branch Davidian complex on April 19, 1993 (<i>Figure 7</i>).	51	28 ²⁾
4 (casing)	Forty mm XM651E1 casing (military rounds) with spent projectiles of the type used by the FBI at the Branch Davidian complex on April 19, 1993 (<i>Figure 8</i>).	75	69
4 (projectile only)		170	73

¹⁾ Not possible to separate casing and projectile after test.
2) Piece of casing only



Item 1, Evidence Label No. A00811749 - Lever and cap from expended hand delivered flash bang grenade, not tested and tested, respectively. Figure 5





Figure 6 Item 2 Evidence Label No. A00811748 - Forty millimeter flash Bang casing and projectile fired from a M-79 Grenade Launcher, not tested and tested, respectively.



Figure 7 Item 3 Evidence Label No. A00811108 - Forty millimeter Ferret casing, wadding and projectile, not tested and tested, respectively. The remainder is a piece from the casing.





Figure 8 Item 4 Evidence Label No. A00811102 - Forty millimeter XM651E1 casing (military rounds) and spent projectile, not tested and tested, respectively. The lower picture shows the projectile only.

9 Conclusion

Item 1 Evidence Label No. A00811749, Item 2 Evidence Label No. A00811748 and Item 4 Evidence Label No. A00811102 left remains after exposure to the severe fire conditions, see figures 4, 5 and 7. These remains could have been found amidst the fire debris after the Branch Davidian complex fire. The plastic ferret round and casing of Item 3 Evidence Label No. A00811108 was completely consumed by the fire. Only a piece of the casing remained.



10 References

"Portable fire extinguishers part 1: Description, duration of operation, class A and B fire test", European Committee for Standardization, Brussels, 1996 EN 3-1:1996



Annex B – Heat Penetration Tests

(3 enclosures)

1 Purpose of test

To measure how fast heat would penetrate a sample of the Branch Davidian complex roof construction and cause a temperature rise on the unexposed surface.

2 Customer

The test was performed for Office of Special Counsel ("OSC"), John C. Danforth, St Louis, Missouri, USA.

3 Date of test

The tests were carried out between June 15 - 19, 2000.

4 Test specimens

4.1 Identification and source of test specimens

The following test specimens to be tested in a small fire resistance furnace were delivered to SP by the OSC on May 25, 2000. Double tests were carried out. Photos of the tested products are given in enclosure 1-3.

No	Board	Covering	Comments
1	Plywood 3/8"	#15 standard roof felt + asphalt shingles	Delivered by client
2	Plywood 3/8"	#15 standard roof felt + rolled asphalt	Delivered by client
3	Plywood 1/2"	#15 standard roof felt	Plywood purchased by SP
	-		Roof felt delivered by client

The roof of the Branch Davidian Complex was made of plywood boards with a thickness of 3/8" or 1/2" covered with roof felt and shingles or rolled asphalt. Some areas were covered with roof felt only.

4.2 Measured data

The following data were measured on the roof-covering products.

	#15 std roof felt	Asphalt shingles	Rolled asphalt
Thickness, mm	0.5 - 0.6	3.8 - 4.5	2.5 - 2.7
Area weight, kg/m² (app.)	0.42	4.0	3.7



4.3 **Conditioning**

The test specimens were conditioned at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %.

5 **Test specifications**

Furnace orifice size: 500 mm by 600 mm.

Orientation: Horizontal.

Specimen size: 500 mm by 600 mm.

Fastening: The roof coverings were stapled to the underlying plywood.

6 Test procedure

The specimen was placed on top of a small fire resistance furnace. The temperature in the furnace was increased according to ISO 834. The temperature at the unexposed surface and between the plywood and the roof covering was measured with thermocouples. Visual observations were also taken during the test. The tests were terminated when the fire broke through or when the asphalt covering started to melt.

7 Test results

Test results are given in enclosure 1-3 in form of time temperature diagrams and tables of observations.

Conclusions 8

These tests were carried out to determine the time it takes for heat to penetrate through roof constructions. The tests lasted at least 15 minutes. In reality, failure may occur earlier due to gravity loads and longer spans between supports. The times to reach temperature rises of 10°C at the plywood/cover interface and at the top surface, respectively, are summarized in the table below.

No. Board Co		Covering	vering Time to reach a temperature rise o	
			(min:s)	
			At plywood/cover interface	At top surface
1	Plywood 3/8"	#15 standard roof felt	1:50	4:10
		+ asphalt shingles		
2	Plywood 3/8"	#15 standard roof felt + rolled asphalt	2:20	3:30
3	Plywood 1/2"	#15 standard roof felt	3:00	3:40

Smoke started to appear from the unexposed upper side after about 13 minutes for the specimens with top coverings containing asphalt. For the specimens with only #15 standard roof felt smoke appeared much later.

References 9

ISO 834:1975 "Fire resistance tests: Elements of building construction", International Organisation for Standardisation, Geneva, 1975.





Enclosure 1 of Annex B - Plywood 3/8" with #15 standard roof felt and asphalt shingles

Test specimen

Plywood 3/8" with #15 standard roof felt and asphalt shingles, see Figure 1.

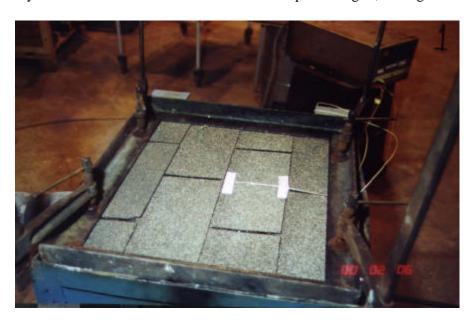


Figure 1 Specimen on top of the small fire resistance furnace, specimen size 500 mm by 600 mm.

Visual observations during test

Observations	Time , (min:s)	
	No. 1:1	No. 1:2
Start of test	0:00	0:00
A pressure increase under the roof covering forced the surface to bend.	9:30	8:00
The pressure disappeared and the surface was flat again.	12:30	11:00
Small blisters occurred on the surface.	13:00	12:00
Small amounts of smoke started to appear.	13:00	14:00
The asphalt started to melt. Smoke production was evident. The test was terminated.	17:30	18:00

Temperature graphs

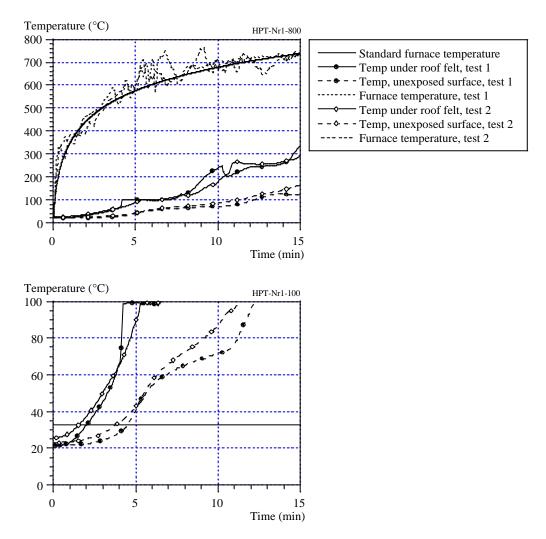


Figure 2 Temperature development of roof construction when exposed to standard furnace temperature according to ISO 834. Two temperature scales. A temperature rise of 10°C above the average of the initial temperatures of all four thermocouples is indicated in the higher resolution diagram at the very bottom.

The diagrams in Figure 2 show the recorded temperature of the duplicate tests as a function of time in the furnace: at the interface between the plywood and the roof covering (under the roof felt), and at the top of the covering (unexposed surface). For clarity the 10°C temperature rise is in the bottom diagram, which has magnified temperature scale.

Enclosure 2 of Annex B - Plywood 3/8" with #15 standard roof felt and rolled asphalt

Test specimen

Plywood 3/8" with #15 standard roof felt and rolled asphalt, Figure 1.



Figure 1 Specimen on top of the small fire resistance furnace, specimen size 500 mm by 600 mm. (The number "3" refers to the third test in the row of six tests.)

Visual observations during test

Observations	Time, (min:s)	
	No. 2:1	No. 2:2
Start of test	0:00	0:00
A pressure increase under the roof covering forced the surface to bend.	8:00	7:10
Small blisters occurred on the surface.	_	10:00
The pressure disappeared and the surface was flat again.	10:10	10:30
Small blisters occurred on the surface.	10:30	-
The thermocouple on the surface of the roof covering lost contact with roof felt. It rose about ½".	11:00	-
The asphalt started to melt. Small amounts of smoke started to appear.	13:00	13:30
Most of the asphalt on the surface had melted. Smoke production was evident. The test was terminated.	15:30	16:00



Temperature graphs

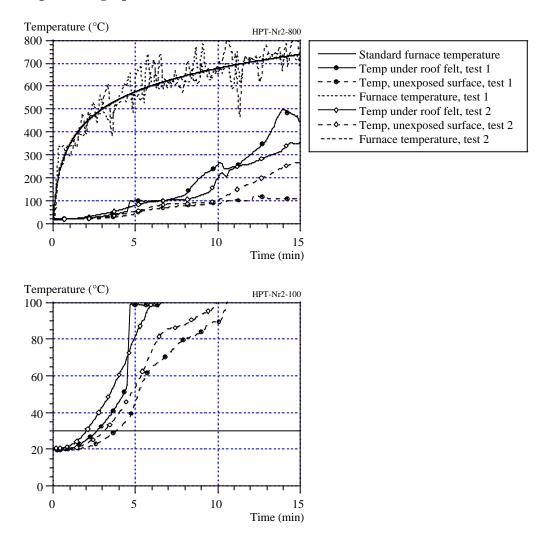


Figure 2 Temperature development of roof construction when exposed to standard furnace temperature according to ISO 834. Two temperature scales. A temperature rise of 10°C above the average of the initial temperatures of all four thermocouples is indicated in the higher resolution diagram at the very bottom.

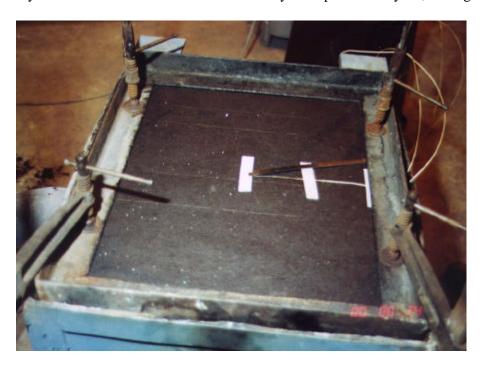
The diagrams in Figure 2 show the recorded temperature of the duplicate tests as a function of time in the furnace: at the interface between the plywood and the roof covering (under the roof felt), and at the top of the covering (unexposed surface). For clarity the 10°C temperature rise is in the bottom diagram, which has magnified temperature scale.



Enclosure 3 of Annex B -Plywood 1/2" with #15 standard roof felt

Test specimen

Plywood 1/2" with #15 standard roof felt. Plywood purchased by SP, see Figure 1.



Specimen on top of the small fire resistance furnace, specimen size 500 mm by Figure 1 600 mm.

Visual observations during test

Observations	Time, (min	:s)
	No. 1:1	No. 1:2
Start of test	0:00	0:00
A pressure increase under the roof covering forced	10:00	13:00
the surface to bend.		
The asphalt started to melt.	13:30	11:00
Small amounts of smoke started to appear.	17:30	-
Small amounts of smoke started to appear.	-	19:00
Γhe smoke production was evident.	-	21:00
Fire broke through the surface and the smoke production was evident. The test was terminated.	21:00	-
Fire broke through the surface. The test was terminated.	-	23:00



Temperature graphs

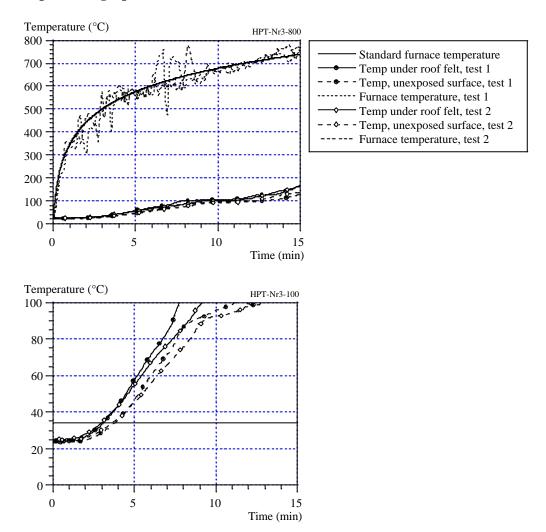


Figure 2 Temperature development of roof construction when exposed to standard furnace temperature according to ISO 834. Two temperature scales. A temperature rise of 10°C above the average of the initial temperatures of all four thermocouples is indicated in the higher resolution diagram at the very bottom.

The diagrams in Figure 2 show the recorded temperature of the duplicate tests as a function of time in the furnace: at the interface between the plywood and the roof covering (under the roof felt), and at the top of the covering (unexposed surface). For clarity the 10°C temperature rise is in the bottom diagram, which has magnified temperature scale.



Annex C – Cone Calorimeter testing and prediction of the burning behaviour in the Room/Corner Test

(6 enclosures)

1 Purpose of test

The purpose of the small-scale fire tests reported here was to obtain information about the burning properties of the interior wall and ceiling surfaces of the Branch Davidian complex. The best available small-scale test method for this purpose is the Cone Calorimeter, see figure 1. It is an international standard ISO 5660-1 as well as an American standard ASTM E 1354. The method was developed in the USA by the National Institute of Standards and Technology (NIST).

To get a better understanding of what the small scale test results mean in a real fire situation, the results obtained in the Cone Colorimeter were used to predict time to flashover (flames coming out of the doorway) in a small room according to ISO 9705, the Room/Corner Test.

2 Customer

The test and prediction were performed for Office of Special Counsel ("OSC"), John C. Danforth, St Louis, Missouri, USA.

3 Date of test

The tests were carried out on June 7, 2000.

4 Test specimens

4.1 Identification and source of test specimens

The following test specimens to be tested in ISO 5660-1 were delivered to SP by OSC on May 25, 2000. Where enough material was available double tests were carried out. Photos of the tested products are given in enclosures 1-4.

No.	Product	No. of tests
1	Plywood 3/8" without any surface treatment	2
2	Plywood 5/8" with external side grooves	1
3	Masonite 1/2" with external side treatment 1	2
4	Masonite 3/8" with external side treatment 2	1

The roof of the Branch Davidian complex was made of plywood boards with a thickness of 3/8" or 1/2" covered with roof felt and shingles or rolled asphalt. The 3/8" plywood was tested in order to assume a fire from underneath. The 5/8" plywood, which presumably had been a part of the wall, had grooves on the facade side, the outside. It was tested from the un-grooved inside. The same applies to the masonites. They were treated on the outside and the tests were carried out from the inside.



4.2 Measured data

Measured data of the test specimens are given in enclosures 1 - 4.

4.3 **Conditioning**

The test specimens were conditioned at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %.

5 **Test specifications**

 25 kW/ m^2 . Irradiance level: Orientation: Horizontal.

Backing: No other than the non-combustible required in the standard.

The product was cut in sheets of 100 mm x 100 mm, enclosed in al-Fastening:

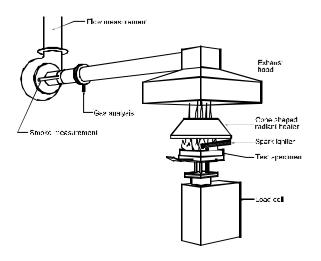
foil on back and sides and loosely put on the backing.

The retainer frame was used. Note:

Single or duplicate tests were performed. In addition to ISO 5660-1 smoke production rate was measured with a laser light system.

6 Test procedure

In the Cone Calorimeter, ISO 5660-1, specimens of 10 cm by 10 cm are exposed to controlled levels of radiant heating. The specimen surface is thereby heated and an external spark igniter ignites the pyrolysis gases from the specimen. The combustion gases are collected by a hood and extracted through a duct. The heat release rate (HRR) is determined by measurements of the oxygen consumption derived from the oxygen concentration and the mass flow rate in the exhaust duct. The specimen weight loss is measured during testing.





The Cone Calorimeter according to the international standard ISO 5660 Figure 1



7 Cone Calorimeter test results

Test results according to ISO 5660-1 are given in enclosure 1 - 6. All tests were carried out with an external irradiations level of 25 kW/m² produced by the cone heater. The test results comprise derived standard data from the Cone Calorimeter tests.

8 Full scale predictions

The predicted results for the ISO 9705 Room/Corner Test based on the results of ISO 5660-1 Cone Calorimeter tests are given in the table below and in enclosure 6. The Room/Corner Test equipment is shown in figure 2.

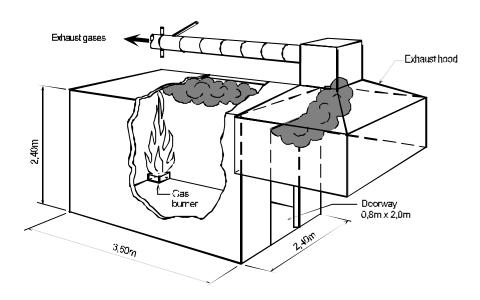


Figure 2 The ISO 9705 Room/Corner Test equipment. The test specimen is mounted on the walls and in the ceiling

9 Summary of results

The table below contains times to ignition and times to second peak of the heat release curve from the Cone Calorimeter tests as well as predicted average times to flashover in the Room/Corner Test. It must be noted that the ignition time depends very much on the irradiance level. At higher irradiance levels the ignition time may be considerably reduced.

Products tested	Time to ignition (min:sec)	Time to second peak (min:sec)	Predicted time to f/o(min:sec)*
Plywood 3/8" w/o. any surf. treatm.	1:53	7:00	2:47
Plywood 5/8" w. ext. side grooves	2:43	15:00	4:29
Masonite 1/2" w. ext. side treatm. 1	1:58	10:00	3:09
Masonite 3/8" w. ext. side treatm. 2	1:59	11:00	3:00

^{*}See enclosure 6 and discussion of predicted results below



10 Discussions

10.1 Discussion of Cone Calorimeter results

The results indicate that the products have fire technical properties similar to wood panels and will therefore behave similar in a fire. The time to consume the specimen varied between 7 and 15 minutes (time to second peak). The second peak of heat release arose when the product was about to burn through. Note that the burning rates drop due to the creation of a protective char layer by a factor of 3 for the plywoods and a factor 2 for the masonites after the first peak.

The irradiance level chosen, 25 kW/m², is relatively low. In real fires, two or three times as high levels can occur. In general, time to ignition decreases with the irradiance level squared. The burning rate, however, increases only marginally for wooden products.

10.2 Discussion of predicted results

In the Room/Corner Test the test specimen is mounted on the walls and in the ceiling and a gas diffusion burner is placed in a corner. Igniting the burner, which runs at 100 kW yielding flames that just reach the ceiling, starts the test. The time it takes for the fire to develop so much that flames come out of the doorway, i.e. time to flashover, is the most important parameter measured. This test as well as the Cone Calorimeter test originates from USA.

The prediction is based on the model developed at SP by Ulf Wickström and Ulf Göransson (see Wickström and Göransson, "Full-scale/Bench-scale Correlations of Wall and Ceiling linings" Journal of Fire and Materials, Vol. 16,1992). The model has proven to yield reliable predictions particularly for cellulosic materials like wood and derivatives thereof like particleboard. The prediction model takes into account the ignition time as well as the heat release rate as a function of time to predict the heat release rate in the Room/Corner Test.

11 Conclusions

The tested products have fire properties normal for wood products. They are not likely to ignite easily unless exposed directly to flames. Time to reach flashover in a small room when a burning item is placed in a corner yielding flames that reach the ceiling is in the order of a few minutes.

In a larger or more ventilated room it would take a longer time. Flames emerging out of the room of the fire origin generally means that not enough air (oxygen) is available inside the room for the combustion process. Excessive ventilation due to large openings or effects of external winds before flashover cools the fire and reduces the length of the flames. That increases the time to flashover or may even prevent flashover to occur. Do also note the burning characteristics of wooden products in the Cone Calorimeter tests. After a couple of minutes of heat exposure, a first peak of heat release rate develops. Then the burning rate reduces substantially as char develops on the wooden surface. Thus, a surface that has burnt and then re-ignites, will burn at a lower rate a second time.



12 References

ISO 5660-1:1993 "Fire tests: Reaction to fire - Rate of heat release from building

products (Cone Calorimeter method)", International Organisation

for Standardisation, Geneva, 1993.

ASTM E 1354:1997 "Test method for heat and visible smoke release rates for

materials and products using an oxygen consumption

calorimeter", USA, 1997.

ISO 9705:1993 "Fire tests: Full scale room test for surface products",

International Organisation for Standardisation, Geneva, 1993.



Enclosure 1 of Annex C – Cone Calorimeter tests of plywood 3/8" without any surface treatment

Test specimen

Plywood 3/8" without any surface treatment see figure 1.



The received sample of plywood 3/8" without any surface treatment. Figure 1

Measured data

Thickness 8.6 - 8.8 mm. Density $590 - 600 \text{ kg/m}^3$.

Test results

Property	Name of variable	No. 1:1	No. 1:2	Average
Flashing (min:s)	$\mathbf{t}_{\mathrm{flash}}$			
Ignition (min:s)	t_{ign}	01:44	02:02	01:53
All flaming ceased (min:s)	$t_{\rm ext}$	09:09	09:48	09:29
Test time (min:s)	t_{test}	11:19	11:48	11:34
Heat release rate (kW/m ²)	q	See figure	2	
Peak heat release rate (kW/m ²)	q_{max}	176	193	184
Average heat release, 3 min (kW/m ²)	q_{180}	111	102	106
Average heat release, 5 min (kW/m ²)	q_{300}	110	118	114
Total heat produced (MJ/m ²)	THR	50.9	58.3	54.6
Smoke production rate (m^2/m^2s)	SPR	See figure 3		
Peak smoke production (m ² /m ² s)	SPR_{max}	1.24	1.03	1.14
Total smoke produced (m ² /m ²)	TSP	218	247	232
Sample mass before test (g)	$Mass_0$	46.8	48.0	47.4
Average mass loss rate (g/m ² s)	MLR_{ave}	6.86	7.07	6.96
Total mass loss (g)	TML	34.7	36.4	35.6
Effective heat of combustion (MJ/kg)	ΔH_{c}	12.9	14.0	13.5



Specific smoke production (m ² /kg)	SEA	55	60	57
Volume flow in exhaust duct (l/s)	V	24	24	24

Graphs of heat release rate and smoke production rate

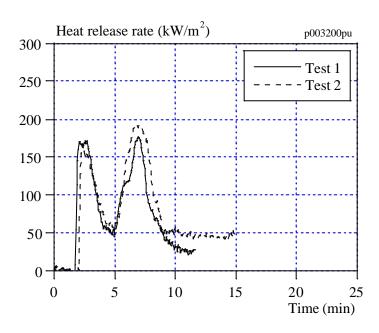


Figure 2 Heat release rate for plywood 3/8" without any surface treatment, double tests at an irradiance of 25 kW/m^2 .

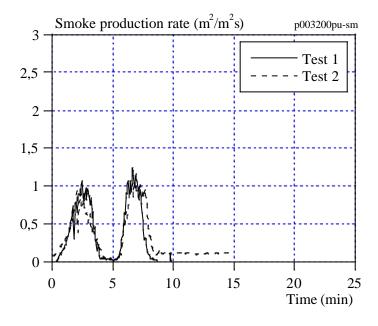


Figure 3 Smoke production rate for plywood 3/8" without any surface treatment, double tests at an irradiance of 25 kW/m².



Enclosure 2 of Annex C – Cone Calorimeter tests of plywood 5/8" with external side grooves

Test specimen

Plywood 5/8" with external side grooves, see figure 1.





Figure 1 The received sample of plywood 5/8" with external side grooves. The left photo shows the external side. The un-grooved side was exposed to the radiant heat.

Measured data

Thickness 14.6 – 14.7 mm. Density 600 kg/m³ approximately.

Test results

Property	Name of variable	No. 2
Flashing (min:s)	$\mathbf{t}_{\mathrm{flash}}$	_
Ignition (min:s)	$\mathbf{t}_{ ext{ign}}$	02:43
All flaming ceased (min:s)	$t_{\rm ext}$	21:19
Test time (min:s)	$\mathbf{t}_{ ext{test}}$	23:19
Heat release rate (kW/m ²)	q	See figure 2
Peak heat release rate (kW/m ²)	q_{max}	174
Average heat release, 3 min (kW/m ²)	q_{180}	100
Average heat release, 5 min (kW/m ²)	q_{300}	81
Total heat produced (MJ/m ²)	THR	96.8
Smoke production rate (m ² /m ² s)	SPR	See figure 3
Peak smoke production (m ² /m ² s)	SPR_{max}	1.23
Total smoke produced (m ² /m ²)	TSP	395
Sample mass before test (g)	$Mass_0$	96.3
Average mass loss rate (g/m ² s)	MLR_{ave}	6.59
Total mass loss (g)	TML	71.7
Effective heat of combustion (MJ/kg)	$\Delta H_{ m c}$	11.8
Specific smoke production (m ² /kg)	SEA	48
Volume flow in exhaust duct (l/s)	V	24



Graphs of heat release rate and smoke production rate

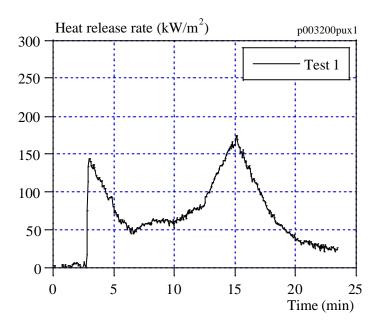


Figure 2 Heat release rate for plywood 5/8" with external side grooves, single test at an irradiance of 25 kW/m^2 .

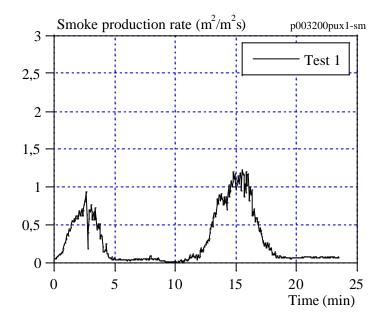


Figure 3 Smoke production rate for plywood 5/8" with external side grooves, single test at an irradiance of 25 kW/m².



Enclosure 3 of Annex C – Cone Calorimeter tests of Masonite 1/2" with external side treatment 1

Test specimen

Masonite 1/2" with external side treatment 1, see figure 1.





Figure 1 The sample of masonite 1/2" with external side treatment 1. The left photo shows the external side. The inside was exposed to the radiant heat.

Measured data

Thickness 11.4 – 11.9 mm. Density 750 kg/m³ approximately.

Test results

Property	Name of	No. 3:1	No. 3:2	Average
	variable			_
Flashing (min:s)	$\mathbf{t}_{\mathrm{flash}}$			
Ignition (min:s)	t_{ign}	01:57	01:59	01:58
All flaming ceased (min:s)	$t_{\rm ext}$	16:04	18:24	17:14
Test time (min:s)	t_{test}	18:04	20:24	19:14
Heat release rate (kW/m ²)	q	See figure	2	
Peak heat release rate (kW/m ²)	q_{max}	204	286	245
Average heat release, 3 min (kW/m ²)	q_{180}	104	104	104
Average heat release, 5 min (kW/m ²)	q_{300}	91	90	91
Total heat produced (MJ/m ²)	THR	86.8	105.4	96.1
Smoke production rate (m^2/m^2s)	SPR	See figure 3		
Peak smoke production (m ² /m ² s)	SPR_{max}	2.14	2.62	2.38
Total smoke produced (m ² /m ²)	TSP	415	466	440
Sample mass before test (g)	$Mass_0$	88.8	92.5	90.6
Average mass loss rate (g/m ² s)	MLR_{ave}	7.68	7.35	7.52
Total mass loss (g)	TML	65.4	71.5	68.4
Effective heat of combustion (MJ/kg)	ΔH_{c}	11.7	13.0	12.3
Specific smoke production (m ² /kg)	SEA	56	57	57
Volume flow in exhaust duct (l/s)	V	24	24	24



Graphs of heat release rate and smoke production rate

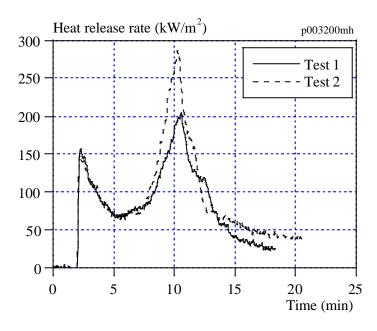


Figure 2 Heat release rate for masonite 1/2" with external side treatment 1, double tests at an irradiance of 25 kW/m^2 .

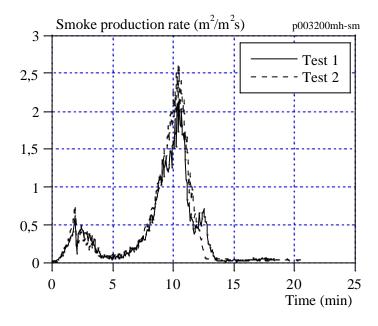


Figure 3 Smoke production rate for masonite 1/2" with external side treatment 1, double tests at an irradiance of 25 kW/m^2 .



Enclosure 4 of Annex C – Cone Calorimeter tests of Masonite 3/8" with external side treatment 2

Test specimen

Masonite 3/8" with external side treatment 2, see figure 1.





Figure 1 The received sample of masonite 3/8" with external side treatment 2. The left photo shows the external side. The photo to the right shows the side of the test specimen, which was exposed to radiant heat. The specimen had to be comprised of two pieces due to the insufficient width of the sample.

Measured data

Thickness 9.5 - 9.7 mm. Density 800 kg/m^3 approximately.

Test results

Property	Name of variable	No. 1:1
Flashing (min:s)	t_{flash}	_
Ignition (min:s)	\mathbf{t}_{ign}	01:59
All flaming ceased (min:s)	$\mathbf{t}_{\mathrm{ext}}$	15:27
Test time (min:s)	$\mathbf{t}_{ ext{test}}$	17:27
Heat release rate (kW/m ²)	q	See figure 2
Peak heat release rate (kW/m ²)	q_{max}	164
Average heat rele ase, 3 min (kW/m ²)	q_{180}	126
Average heat release, 5 min (kW/m ²)	q_{300}	113
Total heat produced (MJ/m ²)	THR	98.4
Smoke production rate (m^2/m^2s)	SPR	See figure 3
Peak smoke production (m ² /m ² s)	$\mathrm{SPR}_{\mathrm{max}}$	1.31
Total smoke produced (m ² /m ²)	TSP	468
Sample mass before test (g)	$Mass_0$	75.9
Average mass loss rate (g/m ² s)	MLR_{ave}	7.47
Total mass loss (g)	TML	61.0



Effective heat of combustion (MJ/kg)	$\Delta H_{ m c}$	14.2
Specific smoke production (m ² /kg)	SEA	56
Volume flow in exhaust duct (l/s)	V	24

Graphs of heat release rate and smoke production rate

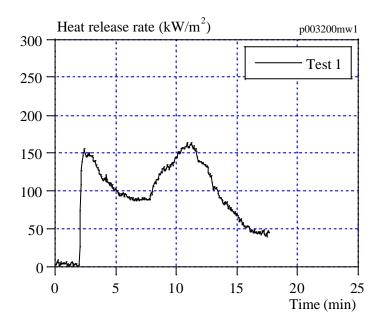


Figure 2 Heat release rate for masonite 3/8" with external side treatment 2, single test at an irradiance of 25 kW/m^2 .

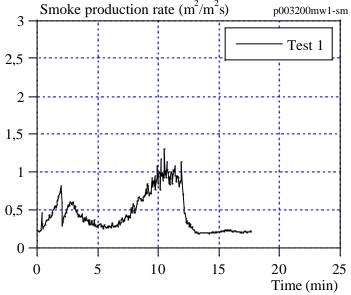


Figure 3 Smoke production rate for masonite 3/8" with external side treatment 2, single test at an irradiance of 25 kW/m^2 .



Enclosure 5 of Annex C – Cone Calorimeter test results explanation according to ISO 5660

Parameter	Explanation
Test start	The test specimen is subjected to the irradiance and the clock is started.
t_{flash}	Time from test start until flames with shorter duration than 1 s.
t_{ign}	Time from test start until sustained flaming.
t _{ext}	Time from test start until the flames have died out.
End of test	Defined as the time when both, the product has been extinguished for 2 minutes, and the mass loss is less than 150 g/m^2 during 1 minute.
t _{test}	Test time. From test start until end of test.
q_{max}	Peak heat release rate during the entire test.
q 180	Average heat release rate during 3 minutes from ignition. If the test is terminated before, the heat release rate is taken as 0 from the end of test.
Q 300	Average heat release rate during 5 minutes from ignition. If the test is terminated before, the heat release rate is taken as 0 from the end of test.
THR	Total Heat Released from test start until end of test.
SPR _{max}	Peak Smoke Production Rate from test start until end of test.
TSP	Total Smoke Produced from test start until end of test.
MLR_{ave}	Mass Loss Rate. Average mass loss rate from ignition until end of test.
TML	Total mass loss from ignition until end of test.
$\Delta H_{ m c}$	Effective heat of combustion calculated as the ratio between total energy released and total mass loss calculated from test start until end of test.
SEA	Specific Extinction Area defined as the ratio between total smoke released and total mass loss calculated from test start until end of test.
V	Volume flow rate in exhaust duct. Average during the test.



Enclosure 6 of Annex C – Prediction of Room/Corner Test results based on Cone Calorimeter test results

Input data for the prediction

The model uses heat release rate and time to ignition measured in the Cone Calorimeter from tests at an irradiance of 25 kW/m².

The results of the prediction of flashover time and heat release rate are given the tables below and in the figures 1 - 4. Flashover as defined here is deemed to occur when the heat release rate reaches 1000 kW. In all cases the peak heat release rate is more than 1000 kW.

Prediction results

Plywood 3/8" without any surface treatment

Property	Test 1	Test 2
Ignition time used (min:s)	1:44	2:02
Predicted flashover time (based on a heat release rate of 1000 kW) (min:s)	2:29	3:06

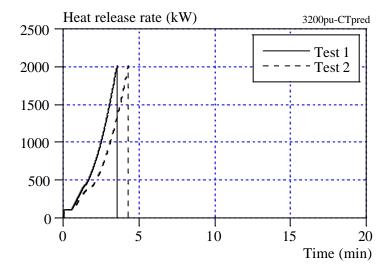


Figure 1 Predicted heat release rate in the Room/Corner Test (ISO 9705) based on Cone Calorimeter tests for plywood 3/8" without any surface treament.



Plywood 5/8" with external side grooves

Property	Test 1
Ignition time used (min:s) Predicted flashover time (based on a heat release rate of 1000 kW) (min:s)	2:43 4:29

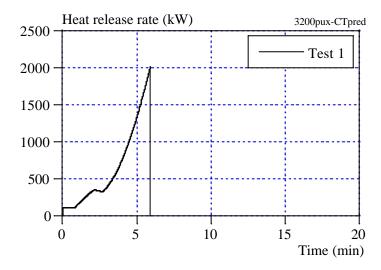


Figure 2 Predicted heat release rate in the Room/Corner Test (ISO 9705) based on Cone Calorimeter tests for plywood 5/8" with external side grooves.

Masonite 1/2" with external side treatment 1

Property	Test 1	Test 2
Ignition time used (min:s) Predicted flashover time (based on a heat release rate	1:57 3:06	1:59 3:12
of 1000 kW) (min:s)	3.00	3.12

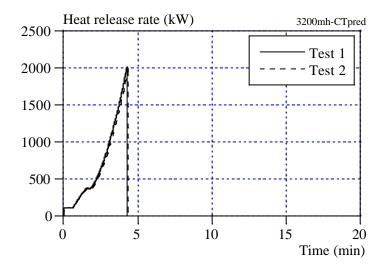


Figure 3 Predicted heat release rate in the Room/Corner Test (ISO 9705) based on Cone Calorimeter tests for masonite 1/2" with external side treatment 1.



Masonite 3/8" with external side treatment 2

Property	Test 1
Ignition time used (min:s)	1:59
Predicted flashover time (based on a heat release rate of 1000 kW) (min:s)	3:00

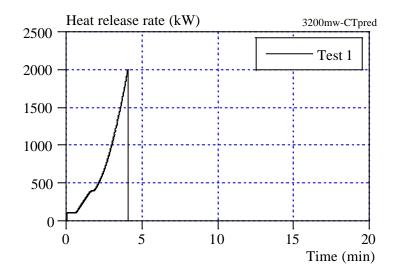


Figure 4 Predicted heat release rate in the Room/Corner Test (ISO 9705) based on Cone Calorimeter tests for masonite 3/8" with external side treatment 2.



Annex D – Estimation of pressure rise in the cafeteria

At the outbreak of the fire, the cafeteria had only two internal openings, i.e. two doorways leading out to the kitchen the reception area. All the windows were boarded. Under these conditions and in room of this size, a pressure will occur when an intensive fire starts due to accelerants and the gas temperature rises. This pressure is highly dependent on fire intensity and opening sizes, which are not very well known. Therefore the estimates and calculations below are very approximate. They are just meant to give an understanding of what levels of pressure can occur in the cafeteria when liquid fuel is ignited and burns at a high rate.

The total volume of the cafeteria¹: 51.5'*31'*8.2' = 370 m^3

Density of air: 1.2 kg/m^3

0.23 * 1.2 *370 kg The total mass oxygen, 23% by mass: Amount of oxygen available for combustion, 50%: 0.5*0.23*370 = 51 kgEnergy release: 13 MJ/kg of oxygen

664 MJ Total heat release without ventilation: 10 MW Assumed peak burning rate:

The volume increase is proportional to the total heat release when assuming no heat loss of the gas mass to the surroundings. For this crude estimate and short time of analysis this is deemed reasonable. Thus at constant pressure and a density and specific heat capacity of air 1.2 kg/m³ and 1.0 kJ/kg, respectively, each MJ of heat release yields a volume increase of three m³ at room temperature 300 K. Therefore according to the ideal gas law:

 $10^6/(1.2*10^3*300) = 2.8 \text{ m}^3/\text{MJ}$ Volume rise at room temperature:

Rate of volume rise at a heat release rate of 10MJ/s: 2.8*10 MJ/s = 28 m³/s

Assumed opening size, (two alternatives): $2 \text{ or } 4 \text{ m}^2$

Gas velocity in opening: 28/2 = 14 m/s or 7 m/s

The pressure drop for gas flow through a rectangular opening is proportional to the gas density and the velocity squared. The proportionality factor depends on the opening geometry but is always larger than unity. Thus the pressure difference between the inside and outside of the cafeteria is larger than as calculated below:

 $0.6*(7)^2 = 29 \text{ N/m}^2$ $0.6*(14)^2 = 118 \text{ N/m}^2$ Pressure at 7.5 m/s: Pressure at 15 m/s:

These estimates are very rough, but they indicate that relatively high pressures can develop when the heat release is high. As a comparison the pressure due to winds at the day of the fire was is in the order of 36 N/m², see Quintiere and Mowrer². Pressures developed at high temperatures of a room fire at quasi-steady conditions (slow temperature rise, large openings) are in the order of 10 to 20 N/m².

For a fuel having a typical heat of combustion of 40 MJ/kg, a total heat release of 520 MJ corresponds to 13 kg of fuel or about 25 litres (= 6 gallons). This amount is in the same order of magnitude as could be held in the empty containers found in the area after the fire according to the report by Wetherington³, i.e. four one-gallon fuel cans at one location and two fuel cans with punctured holes and gasoline at another in the vicinity of the cafeteria.



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- Vector Data System, Imagery Analysis Report, The Events at Waco Texas 19 April 1993, prepared for the US District Court for the Western District of Texas and the Office of Special Counsel
- Quintiere, J., and Mowrer, F., Fire Development Analysis, Mount Carmel Branch Davidian Compound, Waco, Texas, April 19, 1993, submitted September 1993.
- Wetherington, W., Final Report concerning the Fire at the Branch Davidian Complex, Waco, Texas, 19 April 1993, prepared for the Office of Special Counsel Waco Investigation, August 2000.



Annex E - CV for Ulf Wickström

Professor Ulf Wickström heads the department of fire technology at the Swedish National Testing and Research Institute (SP). The department has a staff of more than 50 individuals involved in fire testing and research.

Professor Wickström has a PhD from the Lund University of Technology (1979) in fire technology, a masters of science from University of California (1977), Berkeley, and Master of Science in civil engineering from the above Lund University of Technology (1974).

Professor Wickström was given the name "professor" in 1988 by the Department of Industry of the Swedish Government. His special scientific interest lies heat transfer analysis of structures exposed to fire where he has published several scientific papers.

Professor Wickström joined the Department of Fire Technology of SP in 1979 and has been leading it since 1986. The laboratory is one of the leading of its kind in the world. It is active in international research as well as direct services to industry in the field of fire safety testing and evaluation. The staff of specialists from various engineering fields are experienced and well educated; over ten have obtained academic PhDs.

Professor Wickström has been active during his entire career in international research and standardisation committees and working groups and is internationally well known in the field. For more than ten years he leads the Swedish delegation in the European standardisation committee on fire safety.

ANALYSIS OF FLAMMABILITY HAZARDS ASSOCIATED WITH THE USE OF TEAR GAS AT THE BRANCH DAVIDIAN COMPLEX WACO, TEXAS APRIL 19, 1993



PREPARED FOR

THE OFFICE OF SPECIAL COUNSEL JOHN C. DANFORTH

 \mathbf{BY}

DR. JERRY HAVENS

Fayetteville, Arkansas September 12, 2000

ANALYSIS OF FLAMMABILITY HAZARDS ASSOCIATED WITH THE USE OF TEAR GAS AT THE BRANCH DAVIDIAN COMPLEX WACO, TEXAS APRIL 19, 1993

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COMIS Source Data

1. EXECUTIVE SUMMARY

1.1 Background

In September 1999, the Attorney General of the United States of America appointed Former United States Senator John Danforth to investigate the events that occurred at the Branch Davidian Complex located at Mount Carmel, near Waco, Texas, on April 19, 1993. Senator Danforth established the Office of Special Counsel (OSC) to carry out the investigation, and in December, 1999 the OSC engaged me (Dr. Jerry Havens) to investigate the following questions:

- ! Did the tear gas cause the fire which destroyed the Complex?
- ! Did the tear gas contribute to the fire spread throughout the Complex?
- ! What caused the explosion/fireball observed during the fire in the Complex?

1.2 Tear Gas Concentrations in the Complex

Using data provided me by the Office of Special Counsel regarding the amounts, schedule, and location of all of the tear gas placed in the Complex on April 19, 1993, I calculated the concentrations of the tear gas components orthochlorobenzylidenemalononitrile (CS) and methylene chloride which could have occurred throughout the complex.

1.3 Flammability Hazards Assessment

Using information regarding the physical states (vapor, liquid, solid) of the tear gas components, and the concentrations of the components which could have occurred in the Complex, I determined the flammability hazards posed in the Complex by the tear gas.

1.3.1 Contribution of Tear Gas to Cause of Fire

Based upon my review and analysis, I conclude that the tear gas, which contained CS and methylene chloride, as used in the Branch Davidian Complex, did not cause the fire.

1.3.2 Contribution of Tear Gas to Spread of Fire

Based upon my review and analysis, I conclude that the tear gas, which contained CS and methylene chloride, as used in the Branch Davidian Complex, did not materially contribute to the spread of the fire.

1.4 The BLEVE Observed in the Vicinity of the Bunker

Based upon my review and analysis, I conclude that the explosion/fireball observed during the destruction by fire of the Complex was a boiling liquid expanding vapor explosion (BLEVE) which resulted from the rupture, due to fire exposure, of a liquefied petroleum gas (LPG) tank.

I further conclude that the size and shape of the fireball created by the BLEVE is consistent with the quantity of propane that could have been contained in the tank whose remnants were found in the immediate vicinity of the location of the fireball.

2 INTRODUCTION

2.1 Report Preparation

I, Dr. Jerry Havens, Distinguished Professor of Chemical Engineering and Director of the Chemical Hazards Research Center, University of Arkansas, Fayetteville, compiled this report. I prepared the report acting as a private consultant to the Office of Special Counsel. The statements made here are my responsibility; no responsibility therefor attaches to the University of Arkansas. Scientific and computational support was provided by Dr. Tom Spicer, Professor of Chemical Engineering, University of Arkansas, Fayetteville. The examination of evidence provided me by the Office of Special Counsel was conducted at my home office in Fayetteville, Arkansas, and by Dr. Spicer at his home office in Fayetteville, Arkansas. Biographical sketches for me and for Dr. Spicer are attached hereto as Appendix A.

2.2 Purpose

On September 9, 1999, the Attorney General of the United States appointed Former United States Senator John C. Danforth to investigate certain events that occurred at the Branch Davidian Complex near Waco, Texas, on April 19, 1993. Senator Danforth established the Office of Special Counsel to carry out the investigation. In early December 1999, I was retained by the Office of Special Counsel to investigate the use of tear gas at the Branch Davidian Complex on April 19, 1993. My specific charges were to provide an analysis of the hazards that were presented to the occupants of the Complex on April 19, 1993, sufficient to answer the following questions:

- ! Did the tear gas cause the fire which destroyed the Complex?
- ! Did the tear gas contribute to the fire spread throughout the Complex?
- ! What caused the explosion/fireball observed during the fire in the Complex?

2.3 Disclosure of Interests

Neither I nor Dr. Spicer have any conflicts of interest with any of the parties, witnesses, or experts involved in this matter.

2.4 Methodology

In order to determine the flammability hazards associated with tear gas introduction into the Branch Davidian Complex, I required specification of the following attributes of the tear gas components CS and methylene chloride in all of the individual enclosed spaces in the Complex:

- ! The physical state (i.e. solid, liquid, or gas).
- ! The highest temperatures which might have been achieved.
- ! The concentration (mass per unit volume) as a function of time.

I carefully considered all of the pertinent reports (provided me by the Office of Special Counsel) by several experts regarding the flammability aspects of the events at the Branch Davidian Complex on April 19, 1993. I immediately identified the primary need to determine as accurately as possible the concentration levels of the tear gas (components) inside the Complex. My careful review of all of the materials provided me revealed that prior analyses had never considered the effects (on the tear gas concentrations) of the ventilation of the complex that resulted from the strong wind that was blowing during the entire morning before the fire started. It followed that a first requirement of my analysis would be to identify an appropriate method to estimate the effect of the wind driven ventilation on the tear gas concentrations inside the Complex.

To estimate the tear gas concentrations inside the Complex, I utilized the COMIS computer model, with input data (provided me by the Office of Special Counsel) specifying the amounts and the time schedule of placement of the tear gas in the Complex, to estimate the (time varying) concentrations of the tear gas in all of the rooms, halls, and stairwells in the Complex during the period beginning at 6 a.m. and ending at the time of the fire shortly after noon on April 19, 1993. The COMIS results were provided to the Office of Special Council and its designated toxicology experts for further (toxicological) analyses. I utilized the COMIS results to estimate the concentrations of both tear gas components (CS and methylene chloride) in order to determine whether either could burn under the prevailing conditions (of concentration and temperature). Finally, I considered whether it was possible for sufficient amounts of either of the components to accumulate on the surfaces in the enclosed spaces of the building (either due to direct impact (splashing) or settling in areas that might have not been as effectively ventilated) to cause or contribute to the spread of the fire.

I performed additional computer modeling to determine the size and extent of any potentially flammable zone which might have occurred during the period(s) of injection of tear gas by the Model 5 Protectojet dispensers mounted on the combat engineering vehicles. I undertook this investigation to determine whether the tear gas sprayed into the Complex (by the Protectojets) could have been ignited had it come into contact with an open flame (or other sufficiently energetic) ignition source (such as a lighted gas lantern).

Finally, I analyzed video recordings of the explosion/fireball observed in the vicinity of the bunker to determine the fireball's size and duration. I also studied photographs and dimensions of the ruptured LPG tank that was found in the vicinity of the location where the explosion/fireball was observed. I utilized combustion and fluid mechanics theory and data from the scientific literature to develop an opinion regarding the cause and origin of the explosion/fireball.

3 DESCRIPTION OF TEAR GAS

The common designation for the tear gas used at the Branch Davidian Complex is CS. The identifier CS is derived from the names of the two persons who are identified with its synthesis in 1928 - Carson and Stoughton.

CS is used in several forms, both pure and mixed with other materials, depending on the application and the associated desired effects. There are four basic forms which have been widely utilized; CS, CS1, CS2, and CSX. CS (referring to the first form), is normally dispersed as a dry powder, either thermally as a solid aerosol (utilizing a small explosive device), or as a liquid aerosol by dissolving it in a carrier material such as methylene chloride. CS1 and CS2 are blends of CS and secondary materials which are primarily designed to increase the persistence of the material's irritating characteristics. CSX is a specific mixture of CS with trioctylphosphite which was developed for dissemination as a liquid. It is important to distinguish the different forms, because there are different degrees and types of hazards which might result from their use.

There has been considerable confusion about the type of CS, as well as the types of delivery systems, used at the Branch Davidian Complex. The Office of Special Counsel has determined that only CS (the first of the four designations above) was used, and there were (only) three different delivery systems used:

- ! Model 5 Protectojet The Protectojets were essentially steel cylinders (canisters), containing CS dissolved in methylene chloride and pressurized with carbon dioxide, which were mounted on a boom extending from a combat engineering vehicle. The boom was used to breach the building siding (or window), after which the entire contents of the canister were ejected (as a liquid aerosol) during a period of about 15 seconds. A canister contained 1070 grams methylene chloride and 30 grams CS.
- ! Ferret Ferret rounds were launched through windows (or other openings) into the Complex. Upon impact on hard surfaces in the Complex, the Ferret rounds burst and released the CS (dissolved in methylene chloride) in the form of a liquid aerosol. The introduction of the tear gas by this method was essentially instantaneous. A single Ferret round contained 33.25 grams methylene chloride and 3.7 grams CS.
- ! M651 The Office of Special Counsel has determined that three M651 rounds were fired at the tornado shelter, which is outside the Complex. The M651 rounds contained pyrotechnic components. However, M651 rounds were not used inside the Complex, and they had no material effect on either tear gas concentrations in the complex or the initiation or course of the fire.

It is important to emphasize that for the tear gas insertions <u>inside</u> the Complex, the CS, which is a solid (powder) at the temperatures experienced (at Waco), was dissolved in methylene chloride to enable delivery as an aerosol cloud, and it is important to reemphasize that the delivery systems used to insert tear gas into the Complex did not contain pyrotechnic components. With

both delivery systems used inside the Complex (Model 5 Protectojets and Ferrets), the tear gas (aerosol) was released into the air where the methylene chloride rapidly evaporated leaving small solid CS particles suspended.

Because the method used to deliver CS to a targeted area results in substantial reduction of the concentration (through forced mixing with air), and because further dilution follows in outdoor applications (due to additional mixing with air), it is unlikely that outdoor applications of CS will result in severe health effects because the required concentrations (and persistence of exposure) are highly unlikely. However, if CS is inserted into semi-closed spaces, the ensuing dilution (by mixing with air), and consequent exposure to persons therein, will depend on the ventilation conditions present in the targeted space.

This investigation was directed to the determination of the acute (i.e., immediate as opposed to chronic) hazards to which occupants of the Branch Davidian Complex were exposed due to the use of tear gas inside the Complex. The primary purpose of my investigation was to identify the flammability hazards posed in the Complex by the tear gas. Identification of the flammability hazards required the estimation of the concentration of the tear gas components throughout the complex. My estimates of tear gas concentration in the Complex were also provided to the Official of Special Counsel's designated experts for their analyses of the toxicity hazards to which the occupants of the Complex were exposed. The following summaries of information regarding the tear gas components orthochlorobenzylidenemalononitrile (CS) and methylene chloride are presented here because this (selected) information pertains directly or indirectly to the determination of the concentrations which could have resulted at any location in the Complex, and to the hazards thereby imposed.

3.1 Orthochlorobenzylidenemalononitrile (CS)

Chemical Name

Chemical Formula

orthochlorobenzylidenemalononitrile

 $C_{10}H_5ClN_2$

2-chlorophenylmethylenepropanedinitrile

or

2-chlorobenzalmalononitrile

Pure CS is a white crystalline solid material adopted by the U.S. Army in the late fifties and early sixties for use as an incapacitating agent. Although military (war) use of CS is prohibited by the Chemical Weapons Convention, its use by law enforcement officials for riot and/or crowd control is not, and its use for such purposes has been widespread.

Physical Properties

Molecular Weight 188.62

Density 1.04 g/cc crystalline density; ~0.25 g/cc bulk (powder) density

Melting Point 93 - 95 C

Boiling Point 310 - 315 C (accompanied by thermal decomposition)

Vapor Pressure 0.00034 mm Hg at 20 C

Solubility Soluble in a variety of solvents, including methylene chloride

Flash Point 197 C

In very small quantities, CS has an irritating, pepper-like odor. Relatively low concentrations can cause involuntary eye closure due to burning sensation and profuse tearing, heavy nasal drainage, and stinging sensation to the skin. Higher concentrations can cause severe coughing and tightness of the chest and throat, dizziness, and pulmonary edema which can lead to permanent injury or death.

3.2 Methylene Chloride

<u>Chemical Name</u> <u>Chemical Formula</u>

methylene chloride CH₂Cl₂

or

dichloromethane

Methylene chloride is a clear colorless liquid which has many uses as a solvent and degreasing agent. It was used as the solvent to dissolve solid CS for loading into the delivery systems used at the Branch Davidian Complex.

Physical Properties

Molecular Weight 84.93

Density ~ 1.3 g/cc liquid density; vapor density ~ 2.9 times that of air

Boiling Point 39.8 C

Vapor Pressure 355 mm Hg at 20 C

Flash Point None

Lower Flammable Limit 12% - 14% (at 25 C)

Methylene chloride has a penetrating, ether-like, odor which is irritating at high concentrations. Inhalation of air containing methylene chloride in the range 500 - 1000 ppm can cause minimal anesthetic or narcotic effects. Progressively higher levels can cause dizziness and drunkenness, and still higher concentrations can cause cardiac arrhythmia, unconsciousness, and death.

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4 AMOUNTS, SCHEDULE, AND LOCATIONS OF TEAR GAS PLACEMENT IN THE COMPLEX

The Office of Special Counsel provided the amounts, locations (in the Complex), and time of insertion of all tear gas in the Complex on April 19, 1993. This insertion schedule was based on a careful and detailed review of the FLIR tapes, FBI Event Logs, statements of Branch Davidians, statements of the Hostage Rescue Team tear gas gunners, review of the photographic record, and other eyewitness statements.

Tear gas was introduced by two methods:

- Pispensed from a pressurized canister (Model 5 Protectojet) mounted on a boom extending from a combat engineering vehicle (CEV). The boom was used to breach the building siding (or window), after which the entire contents of the cylinder were ejected during a period of about 15 seconds. A canister contained 1070 grams methylene chloride and 30 grams CS. At the outset of this investigation there was some uncertainty about the location of placement of two canisters in the Complex (at approximately 11:49 and 11:50). Although we were highly confident that two canisters were discharged during this period in the area encompassing Rooms 8, 27, and 30 (See Figure 4.1), there was some uncertainty about the depth of penetration of the CEV and the angle of its boom in the Complex at the time of discharge. Consequently, the following (alternate) scenarios were investigated with COMIS:
 - " Case 1 Two canisters in room 30.
 - " Case 2 Two canisters in room 8.
 - " Case 3 One canister in room 8 and one in room 27.
 - Case 4 Two canisters in room 27.
 - " Case 5 One-half canister in room 27 and one and one-half canisters in room 30.

In due course, the Office of Special Counsel obtained more precise information about the CEV boom penetration depth and angle. The performance specification for the Protectojet states that the dispersion pattern of the gas is "1 yard in width for every 3 yards in distance." At 11:49 the first canister was discharged into the complex when it was approximately 17 feet from the center of Room 27's front wall. Assuming a complete and unimpeded dispersion, the gas would have struck the center of Room 27's front wall in a stream less than 2 yards wide, missing Room 27's doorway situated on the far left of the front wall. At 11:50 the second canister was discharged into the complex when it was approximately 28 feet from the center of Room 27's front wall. Assuming a complete and unimpeded dispersion, the gas would have struck the center of Room 27's front wall in a stream approximately 3 yards wide, with the left most periphery of that dispersion passing through Room 27's only doorway. Even in the unlikely event that the concentration of the gas at the plume's periphery was equal to that of its center, the amount of gas that entered Room 27 could not have exceeded ½ canister under

these measured conditions. Consequently, I focused on this most likely worst case scenario (½ canister in Room 27 and 1½ canister in Room 30) in my subsequent investigation. Although Case 5 is the most likely worst case scenario, some of the other cases indicated higher concentrations in some of the rooms (8, 27, or 30). However, my conclusions regarding flammability hazards in the Complex are not changed by the adoption of any of these (less likely) scenarios.

! Ferret rounds launched through windows (or other openings) into the Complex. Upon impact, the plastic Ferret rounds burst and released the tear gas in the form of a liquid aerosol. The introduction of the tear gas by this method was essentially instantaneous. A single Ferret round contained 33.25 grams methylene chloride and 3.7 grams CS. For purposes of my analysis, I assumed that every Ferret hit its target room and deployed as intended. The actual success rate was something less than perfect, because some of the Ferret rounds were observed to hit the side of the Complex (discharging their contents only outside). In my investigation, I assumed a total of 386 (see Figure 4.1). In my opinion, a 5% uncertainty (i.e., plus or minus 20 Ferret rounds) does not affect the conclusions which I reached based on my assumption of 386 rounds.

Table 4.1 shows the schedule of insertion of all of the Ferret rounds and tear gas canisters, and Figures 4.1 - 4.4 show the floor plans for the four levels of the Complex with the total number of Ferret rounds and Model 5 tear gas canisters discharged in each room (subspace).

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Table 4.1. Location and Time Schedule of Placement of Ferrets and Model 5 Canisters

Zone	Time	Ferret Rounds	Canisters	CS (grams)	MC (grams)
Room 1	06:03		1	30	1070
	07:49	2		7.4	66.5
	09:05		1	30	1070
	11:35	2		7.4	66.5
Room 2					
Room 3					
Room 4					
Room 5	06:05		1	30	1070
	07:46	2		7.4	66.5
	09:07		1	30	1070
	11:33	2		7.4	66.5
Room 6	07:43	2		7.4	66.5
	09:09		1	30	1070
	11:31	2		7.4	66.5
Room 7	07:40	2		7.4	66.5
	09:11		1	30	1070
	11:29	2		7.4	66.5
Room 8					
Room 9					
Room 10					
Room 11					
Room 12	07:19	2		7.4	66.5
	11:15	2		7.4	66.5
Room 13	07:16	2		7.4	66.5
	11:13	2		7.4	66.5
Room 14	07:13	2		7.4	66.5
	11:11	2		7.4	66.5
Room 15	07:10	2		7.4	66.5
	11:09	2		7.4	66.5
Room 16					
Room 17					
Room 18	06:13	2		7.4	66.5
	06:55	2		7.4	66.5
	08:06	2		7.4	66.5
	11:10	1		3.7	33.25
	12:05		1	30	1070
Room 19	06:13	2		7.4	66.5
	06:54	2		7.4	66.5
	07:19	_	1	30	1070
	08:02	2		7.4	66.5
_	11:10	1		3.7	33.25
Room 20	06:13	2		7.4	66.5

Table 4.1. Location and Time Schedule of Placement of Ferrets and Model 5 Canisters

Zone	Time	Ferret Rounds	Canisters	CS (grams)	MC (grams)
	06:56	2		7.4	66.5
	08:10	2		7.4	66.5
	11:10	1		3.7	33.25
	06:13	2		7.4	66.5
	06:30		1	30	1070
	06:57	2		7.4	66.5
	07:34		2	60	2140
	08:14	2		7.4	66.5
	11:10	1		3.7	33.25
	06:13	2		7.4	66.5
	06:58	2 2		7.4	66.5
	08:18	2		7.4	66.5
	11:10	1		3.7	33.25
Room 21					
Room 22	06:13	2		7.4	66.5
	06:59	2		7.4	66.5
	08:22	2		7.4	66.5
	11:10	1		3.7	33.25
Room 23					
Room 24	06:11		1	30	1070
	06:14	24		88.8	798
	06:58	12		44.4	399
	07:35		1	30	1070
	06:13	2		7.4	66.5
	07:00	2		7.4	66.5
	08:26	2		7.4	66.5
Room 25					
Room 26	06:11	6		22.2	199.5
	06:56	3 2		11.1	99.75
	11:33	2		7.4	66.5
	11:40	8		29.6	266
	06:25	8 2 2 2 2 3		7.4	66.5
	06:59	2		7.4	66.5
	08:14	2		7.4	66.5
	11:38	2		7.4	66.5
	12:05	3		11.1	99.75
Room 27	11:49		0.5	15	535
Room 28					
Room 29					
Room 30	11:49		0.5	15	535
	11:50		1	30	1070

Table 4.1. Location and Time Schedule of Placement of Ferrets and Model 5 Canisters

Zone	Time	Ferret Rounds	Canisters	CS (grams)	MC (grams)
Room 31	06:23	2		7.4	66.5
	06:58	2		7.4	66.5
	08:15	2		7.4	66.5
	11:33	2		7.4	66.5
Room 32	07:53		1	30	1070
	08:01	2		7.4	66.5
	11:43	2		7.4	66.5
Room 33	07:55		1	30	1070
	07:58	2		7.4	66.5
	08:20	2		7.4	66.5
	11:41	2		7.4	66.5
	11:45	3		11.1	99.75
Room 34	07:55	2		7.4	66.5
	11:39	2		7.4	66.5
Room 35	07:52	2		7.4	66.5
	11:37	2		7.4	66.5
Room 36	06:21	2		7.4	66.5
	06:57	2		7.4	66.5
	08:14	2		7.4	66.5
	11:28	2		7.4	66.5
Room 37	06:26	3		11.1	99.75
	07:03	1		3.7	33.25
Room 38	06:27	1		3.7	33.25
	07:04	1		3.7	33.25
Room 39	06:28	1		3.7	33.25
	07:04	1		3.7	33.25
Room 40	06:29	1		3.7	33.25
	07:05	1		3.7	33.25
Room 41	07:37	2		7.4	66.5
	11:27	2		7.4	66.5
Room 42	07:34	2		7.4	66.5
	11:25	2		7.4	66.5
Room 43	07:31	2		7.4	66.5
	11:23	2		7.4	66.5
	11:50	1		3.7	33.25
Room 44	07:28	2		7.4	66.5
	11:21	2		7.4	66.5
	11:46	1		3.7	33.25
	11:50	1		3.7	33.25
Room 45	07:25	2		7.4	66.5
	11:19	2		7.4	66.5
Room 46	07:22	2		7.4	66.5

Table 4.1. Location and Time Schedule of Placement of Ferrets and Model 5 Canisters

Zone	Time	Ferret Rounds	Canisters	CS (grams)	MC (grams)
	11:17	2		7.4	66.5
Room 47					
Room 48	07:04	2		7.4	66.5
	11:05	2		7.4	66.5
Room 49	07:01	2		7.4	66.5
	11:03	2		7.4	66.5
Room 50	06:08		1	30	1070
	06:12	2		7.4	66.5
	06:51	2		7.4	66.5
	07:50	2		7.4	66.5
Room 51	06:58	2		7.4	66.5
	11:01	2		7.4	66.5
	06:12	2		7.4	66.5
	06:50	2		7.4	66.5
	07:46	2		7.4	66.5
Room 52	06:11	2		7.4	66.5
	06:52	2		7.4	66.5
	08:09	2		7.4	66.5
	09:40	1		3.7	33.25
	11:03	2		7.4	66.5
Room 53	06:10	2		7.4	66.5
	06:55	1		3.7	33.25
Room 54	06:13	2		7.4	66.5
	06:53	2		7.4	66.5
	08:10	2		7.4	66.5
	09:41	1		3.7	33.25
	11:08	2		7.4	66.5
Room 55	06:07		1	30	1070
	06:12	2		7.4	66.5
	06:52	2		7.4	66.5
	07:54	2		7.4	66.5
	06:12	2		7.4	66.5
	06:53	2		7.4	66.5
	07:58	2		7.4	66.5
Room 56	06:07	3		11.1	99.75
	06:54	1		3.7	33.25
Room 57	06:15	2		7.4	66.5
10011107	06:54	2		7.4	66.5
	08:11	2		7.4	66.5
	09:42	1		3.7	33.25

Table 4.1. Location and Time Schedule of Placement of Ferrets and Model 5 Canisters

Zone	Time	Ferret Rounds	Canisters	CS (grams)	MC (grams)
	11:13	2		7.4	66.5
	06:17	2		7.4	66.5
	06:55	2		7.4	66.5
	08:12	2		7.4	66.5
	09:43	1		3.7	33.25
	11:18	2		7.4	66.5
Room 58	06:12	2		7.4	66.5
	06:48	2		7.4	66.5
	07:38	2		7.4	66.5
	06:12	2		7.4	66.5
	06:49	2		7.4	66.5
	07:42	2		7.4	66.5
Room 59	06:12	2		7.4	66.5
	06:49	2		7.4	66.5
	10:55	2		7.4	66.5
	06:12	2		7.4	66.5
	06:47	2		7.4	66.5
	07:34	2		7.4	66.5
	06:09	2		7.4	66.5
	06:55	1		3.7	33.25
	06:09	2		7.4	66.5
	06:51	2		7.4	66.5
	08:08	2		7.4	66.5
	09:39	1		3.7	33.25
	10:58	2		7.4	66.5
Room 60	06:07	2		7.4	66.5
	06:46	2		7.4	66.5
	10:53	2		7.4	66.5
	06:12	2		7.4	66.5
	06:46	2		7.4	66.5
	07:30	2		7.4	66.5
	06:08	2		7.4	66.5
	06:54	1		3.7	33.25
	06:07	2		7.4	66.5
	06:50	2		7.4	66.5
	08:07	2		7.4	66.5
	09:38	1		3.7	33.25
	10:53	2		7.4	66.5
Foyer	06:17	2		7.4	66.5
•	06:52	2		7.4	66.5
	10:57	2		7.4	66.5
	11:55		1	30	1070

Table 4.1. Location and Time Schedule of Placement of Ferrets and Model 5 Canisters

Zone	Time	Ferret Rounds	Canisters	CS (grams)	MC (grams)
	06:22	2		7.4	66.5
	06:55	2		7.4	66.5
	10:59	2		7.4	66.5
Café stairs	06:30	1		3.7	33.25
	07:05	1		3.7	33.25
Foyer stairs	07:07	2		7.4	66.5
•	11:07	2		7.4	66.5
Hall 53	06:19	2		7.4	66.5
	06:56	2		7.4	66.5
	08:13	2		7.4	66.5
	09:44	1		3.7	33.25
	11:23	2		7.4	66.5
	Total	386	20	2028.2	34234.5

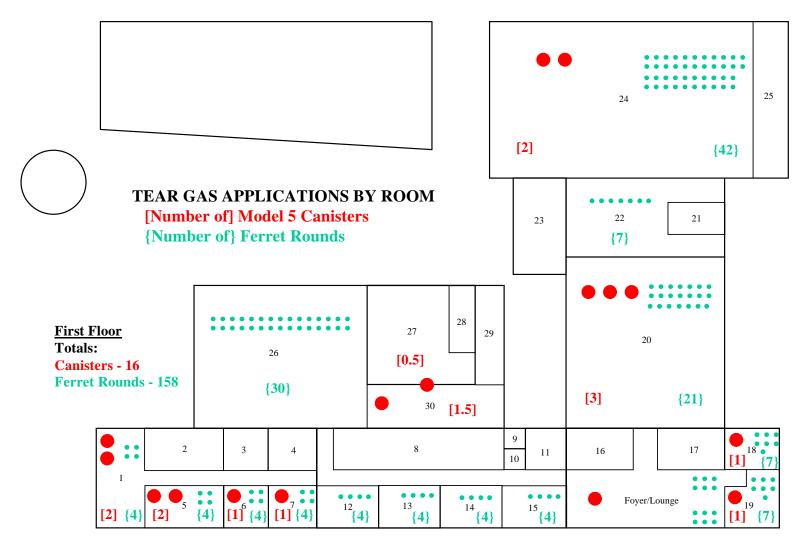


Figure 4.1. Placement of Model 5 Canisters and Ferrets on the First Floor

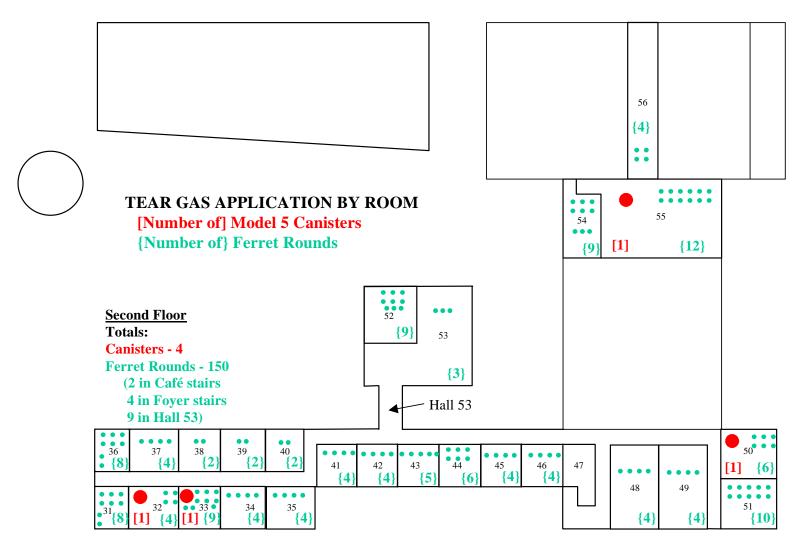


Figure 4.2. Placement of Model 5 Canisters and Ferrets on the Second Floor

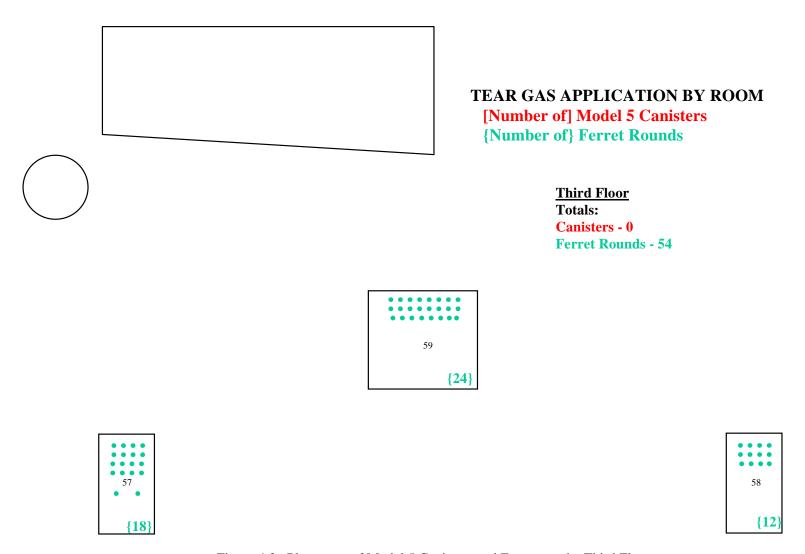


Figure 4.3. Placement of Model 5 Canisters and Ferrets on the Third Floor

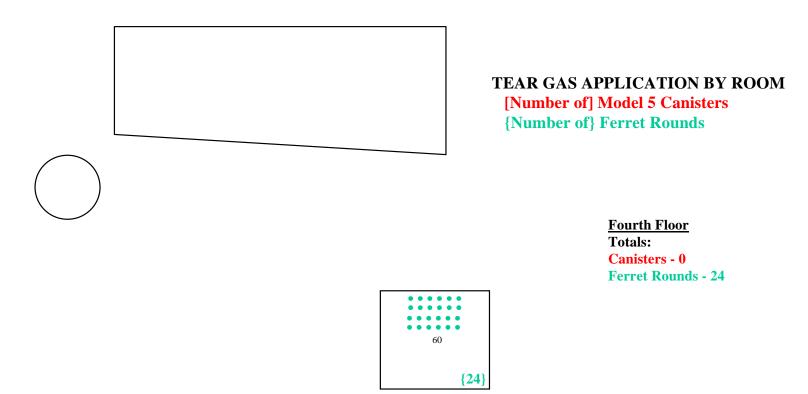


Figure 4.4. Placement of Model 5 Canisters and Ferrets on the Fourth Floor

5 ESTIMATION OF METHYLENE CHLORIDE AND CS CONCENTRATIONS INSIDE THE COMPLEX

In order to assess the flammability hazards caused by the use of tear gas in the Branch Davidian Complex, it was necessary to establish the local, time varying concentration of the tear gas components throughout the Complex. The Complex was composed of approximately 60 separate rooms, on four levels, with interconnecting hallways and stairways.

To estimate the concentrations throughout the Complex during the approximately 6 hour period before the fire started, the following information was required:

- ! Amount, location, and time of entry of the tear gas.
- ! Volume of the rooms (or other spaces) in which the tear gas was placed.
- ! Information required to estimate the movement of air (and tear gas) throughout the Complex due to the wind-driven ventilation.

The amount, location, and time of entry of the tear gas was specified in Section 4.

The Office of Special Counsel provided me with mensuration data developed by Vector Data Systems (U.K.) Ltd. which described the layout of the rooms, halls, and stairways in the Complex. Dimensions of the building and volumes of the rooms, halls, and stairways were provided. Figures 5.1 - 5.4 show the floor plans for the four levels of the Complex with the volumes of the individual rooms and other spaces designated.

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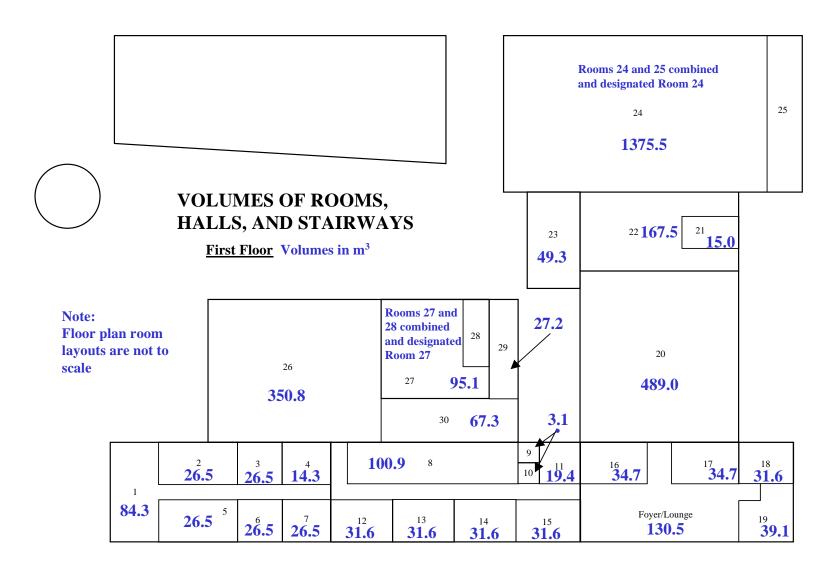


Figure 5.1. Volumes of Rooms, Halls, and Stairways on the First Floor

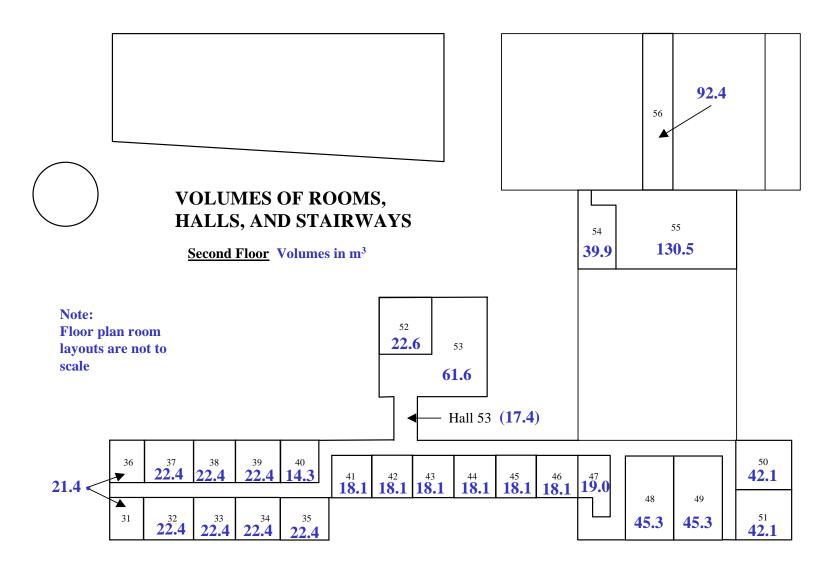


Figure 5.2. Volumes of Rooms, Halls, and Stairways on the Second Floor

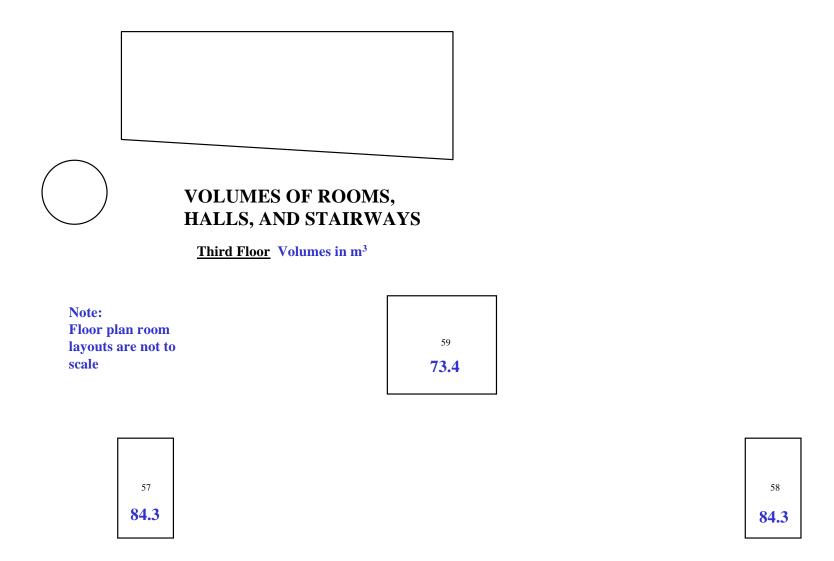


Figure 5.3. Volumes of Rooms, Halls, and Stairways on the Third Floor

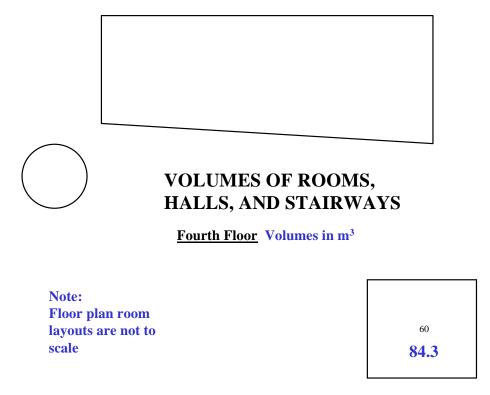


Figure 5.4. Volumes of Rooms, Halls, and Stairways on the Fourth Floor

5.1 Description of the Complex

The Branch Davidian Complex was composed of approximately 60 separate rooms, on four levels, with interconnecting hallways and stairways. The plans showing the volumes of the rooms, hallways, and stairways for all four floors were shown in the previous section.

The primary purpose here is to describe additional features of the Complex which were necessary to estimate the effect of the strong wind on the ventilation of the Complex and the resulting concentrations of tear gas throughout.

Figure 5.5 shows an aerial view of the Complex in which the color codes assigned by the FBI in 1993 to the four sides of the Complex are shown. The "white" side is usually considered the front, the "black" side the back, and the "green" side is nearest the tornado shelter (on the left in Figure 5.5). The square "tower" feature, behind the front door of the Complex, and slightly toward the "red" side, reached the fourth floor level, and the concrete room popularly referred to as the "bunker" (Room 27, see Figure 4.1) was on the first floor level underneath this feature.



Figure 5.5. Aerial View of the Branch Davidian Complex

"White", "Red", "Green", and "Black" Side elevations of the Complex are illustrated in Figure 5.6. The Office of Special Counsel provided me detailed dimensions of the complex, along with the positions and sizes of all windows and doorways in the complex, as well as a detailed specification of the schedule (time), location (position), and dimension of all openings created in the sides of the Complex by the combat engineering vehicles.

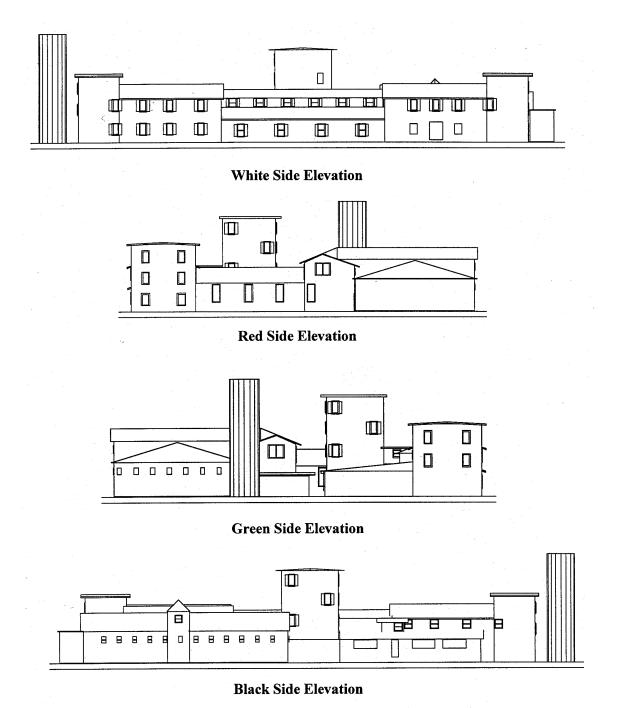


Figure 5.6. Side Elevations of the Complex

5.2 Effect of Ventilation on Concentrations of Methylene Chloride and CS

5.2.1 Sources of Ventilation of the Complex

The term *ventilation* is used here to describe the flow of air through, and between, the compartments (rooms and other connecting spaces such as halls and stairways) of the Branch Davidian Complex. Airflow through the individual compartments of the building was caused by pressure differences between the compartments (air flows from regions of higher pressure to regions of lower pressure). The principal causes of such pressure differences are:

- ! wind:
- ! thermal buoyancy associated with temperature variations; and
- ! mechanical ventilation systems.

Given any of the these potential causes for pressure differences, the distribution, size, and locations of openings connecting the individual compartments significantly affect the pressure distribution throughout the building.

There were no mechanical ventilation systems operating at the Complex on April 19, 1993. Furthermore, there were no heating or cooling systems operating which could have caused temperature variations sufficient to cause important thermal-buoyancy-driven airflows in the building complex. Consequently, the airflows throughout the building were essentially controlled by pressure distributions which resulted from the strong winds that impacted the building.

5.2.2 Description of Pressure (Wind) Induced Ventilation of the Complex

Airflows throughout the Complex were driven by pressure differences caused by the strong wind which impacted the building. The wind produced a velocity and pressure field (distribution) on the exterior surfaces of the building. The pressure distribution on a building's exterior surface are affected by:

- ! the roughness of the surrounding terrain (nonuniformity of ground surface, presence of vegetation, and presence of buildings or other obstacles);
- ! aspect ratio (height to width) of the individual exterior surfaces of the building; and
- ! the wind direction and velocity.

The wind pressure distribution on the exterior surfaces of the Branch Davidian Complex on April 19, 1993, was described, using standard engineering techniques, by the specification of *pressure coefficients* which indicate the "driving force" (due to the pressure) on the exterior surfaces and, as a result, for air flow through openings in the exterior walls of the Complex. The

wind pressure distribution around (the exterior of) the building is normally highest on the windward (upwind) side of the building, and it is highest at points where the direction of the wind is perpendicular to the (local) building face. The pressures on the exterior surface also vary in the vertical direction because the wind speed increases (from a near-zero value at the ground surface) with height. The wind pressures on the exterior of the building result in airflow through the exterior openings in the building and, in turn, drive the airflow patterns throughout the building complex. The complex pathways of air flow through the building are dependent on the size of all of the compartments in the building, the size and type of openings (doorways, windows, cracks) between the individual compartments, and the pattern of connection of all of the compartments.

5.2.3 Prediction of Ventilation of the Complex

Airflow models are used to simulate the rates of incoming and outgoing airflows for a building with known leakage under given weather and (wind) shielding conditions. Additional details about the flow paths and air-mass flows inside a building can be predicted using multizone airflow models (Feustal and Dieres, 1992). Multizone airflow network models simulate the complex flows in a building by accounting for the effects of internal flow resistances. Such models are based on the mass-balance equation, which (as applied in the present context) is simply a requirement that the flow into a given compartment is equal to the flow out of that compartment. The model must determine the (average) pressure which characterizes each of the zones (compartments). Given the specification of the flow network (connectivity), the sizes of the individual compartments, the characteristics of the connecting openings (which determine the resistances to flow through them), and the pressure distribution on the exterior of the building, a system of equations can be solved to calculate the pressures in each of the compartments and the resulting flow pattern that occurs throughout the building.

There has been extensive development of multizone airflow models due to the need to understand the air-mass flow in buildings for several reasons:

- ! The exchange of outside air with inside air is necessary for building ventilation, as well as to supply air necessary for combustion.
- ! Energy is consumed to heat or cool the incoming air to inside comfort temperature.
- ! The airflows throughout the building transport airborne particles, pollutant gases, biological organisms, and (in the case of fire) smoke, thus determining the concentrations to which the building occupants are exposed.

In this investigation, I constructed a multizone airflow computer model of the Branch Davidian Complex to estimate the concentrations of CS and methylene chloride which occurred throughout the Complex during the morning hours of April 19, 1993.

5.2.3.1 The COMIS Program

The COMIS program was developed beginning in the late eighties (Feustal et al., 1989) at the Lawrence Berkeley Laboratory. COMIS was chosen for the present work for several reasons:

- ! The model is non-proprietary and available to the public; the program used here was downloaded from the Internet.
- ! The model has been subjected to substantial testing for consistency and accuracy, and it has been subjected to fairly extensive verification and proof-testing.
- ! The model structure is modular, which extends its utility for such purposes as the present.
- ! The directions for use of the model are reasonably complete, and the specification of required input conditions is unambiguous.
- ! The numerical algorithm for solving the system of nonlinear equations is a proven method.

Although the COMIS program has been subjected to verification tests by comparison of the model's predictions with actual measurements of airflow in buildings as complex as the Branch Davidian Complex, I subjected it to several checks to verify its applicability for the present use. For example, I checked it by application to simple, single zone (compartment), applications where I was able to independently calculate the resulting concentration variation in the space due to air flow therein. Additional checks were made on the program's ability to accurately account for the changing amount of air contaminants (here CS and methylene chloride) as it was moved by the wind through the Complex. All such attempts verified the accuracy and consistency of the program results.

5.2.3.2 Data Required for the COMIS Program

I determined that the airflows in the Complex, and the concentrations of CS and methylene chloride which resulted, were the result (only) of the wind blowing on the Complex. As a result, the input data required for the COMIS calculation of the airflow throughout the Complex fell into two principal categories:

! Environmental Specifications;

- wind direction (with respect to the orientation of the building),
- wind velocity (speed) and variation thereof with height above the ground, which is determined by specification of the velocity at 10 meters elevation above the ground and the surface roughness (a parameter which characterizes the aerodynamic roughness of the site around the building),
- " air temperature,
- " humidity, and
- " atmospheric (barometric) pressure.

! Building Specifications;

- building exterior dimensions,
- sizes, aspect ratios, and positions of all exterior doors, windows, and vents, and all openings made in the exterior and interior walls by the boom-mounted combat engineering vehicles,
- dimensions of all compartments,
- " interconnectivity between compartments, and
- " sizes and types of all openings between compartments.

5.2.3.3 Predicted Room-Average Concentrations of Methylene Chloride and CS

Figures 5.7 - 5.16 show the COMIS-predicted room-average concentrations of methylene chloride and CS inside ten rooms of the Branch Davidian Complex for the period beginning at 6 a.m. and ending shortly after noon on April 19, 1993. These ten rooms were the rooms in the Complex with the highest concentrations of methylene chloride and CS. In order to illustrate the critical importance of the wind-driven ventilation of the Complex on the concentrations of tear gas within, the dashed lines show the maximum room-average concentrations reflecting the assumption of no ventilation. A CD-ROM containing the COMIS-predicted concentrations of methylene chloride and CS in all of the compartments of the Complex for this (most likely) scenario is attached to this report. For completeness, the CD-ROM also contains the COMIS-predicted concentrations of methylene chloride and CS for all of the alternate scenarios described in Section 4, which were considered earlier in my investigation.

5.2.4. Analysis of Concentrations and Utilization for Toxicity Evaluations

Analysis of Figures 5.7 - 5.16, as anticipated, indicated that the effects of ventilation were to substantially reduce the concentrations of both methylene chloride and CS throughout the Complex. This reduction was due to mixing of the tear gas placed into the compartments with air flowing through the compartment, its resulting removal from that compartment to an adjacent compartment, and so on.

All of the COMIS predictions were provided to the Office of Special Counsel and its designated experts, for use in the assessment of the toxicological hazards to which the occupants of the Complex were exposed on April 19, 1993. Consideration of the potential for conditions to exist in which either the methylene chloride or CS could have caused or materially contributed to the fire which began shortly after noon on April 19, 1993, will be presented in the next section.

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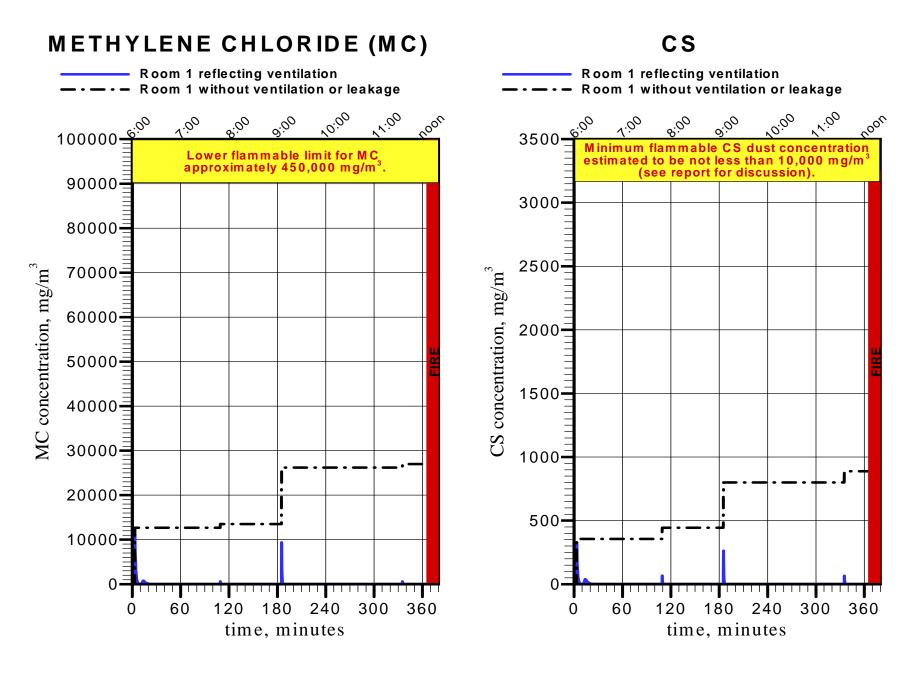


Figure 5.7. Methylene Chloride and CS Concentrations in Room 1

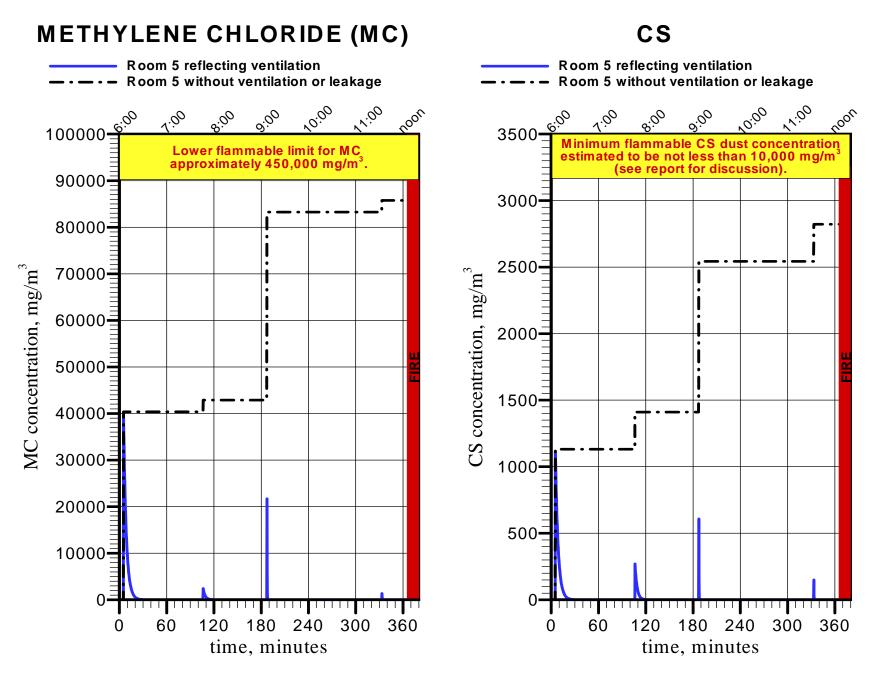


Figure 5.8. Methylene Chloride and CS Concentrations in Room 5

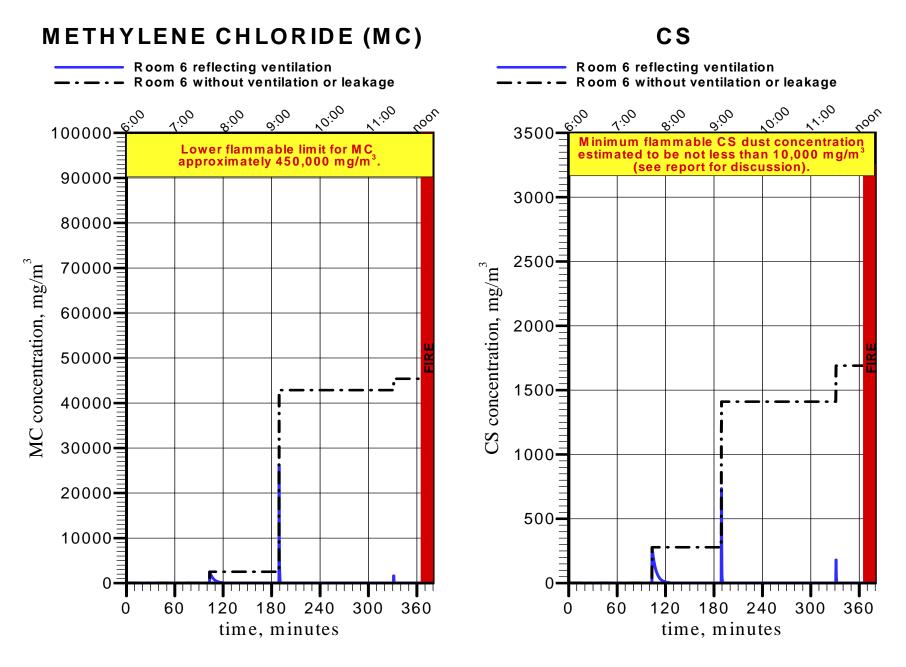


Figure 5.9. Methylene Chloride and CS Concentrations in Room 6

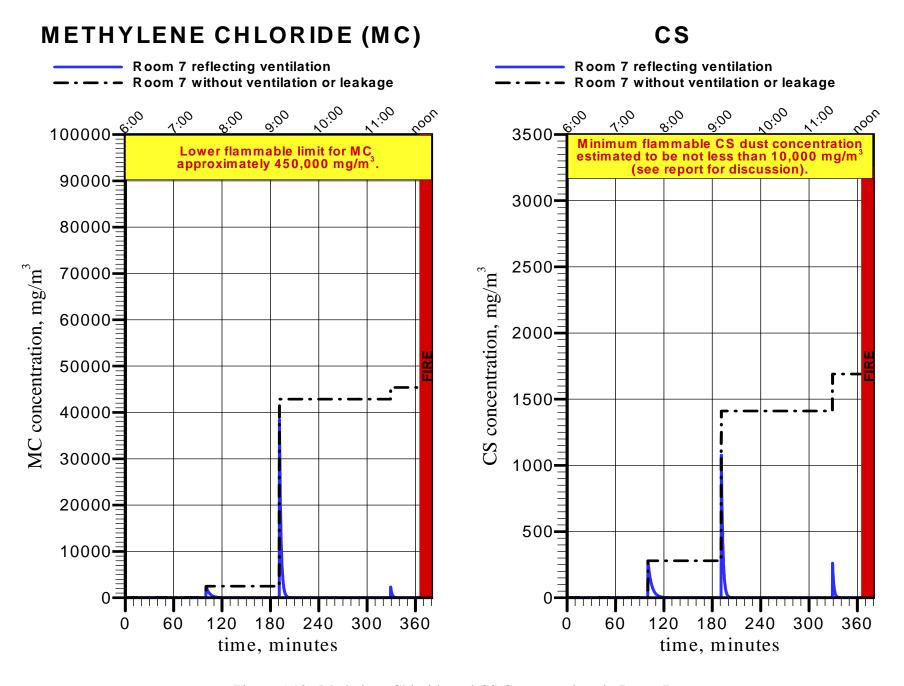


Figure 5.10. Methylene Chloride and CS Concentrations in Room 7

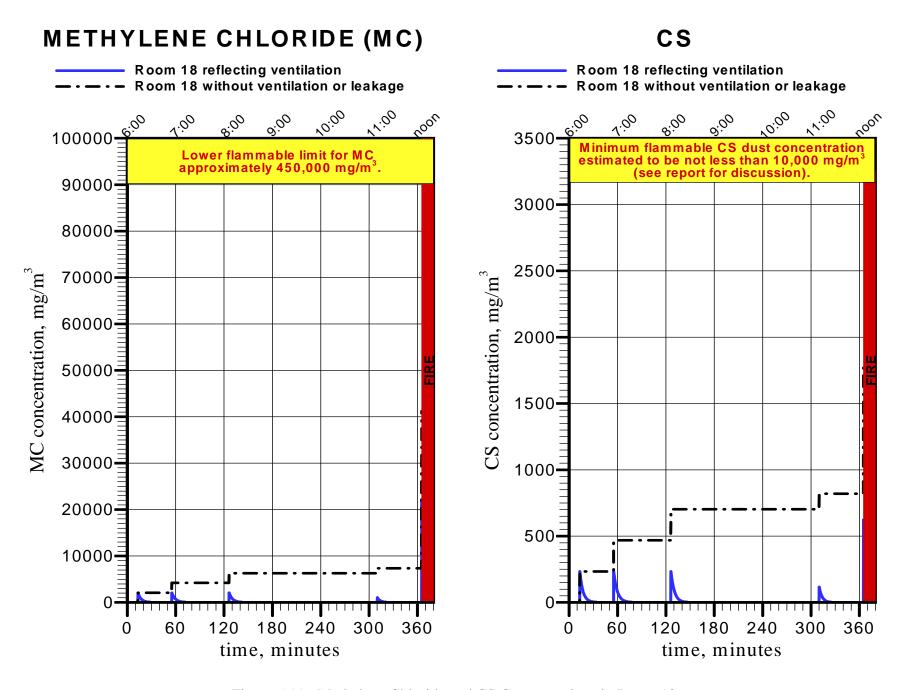


Figure 5.11. Methylene Chloride and CS Concentrations in Room 18

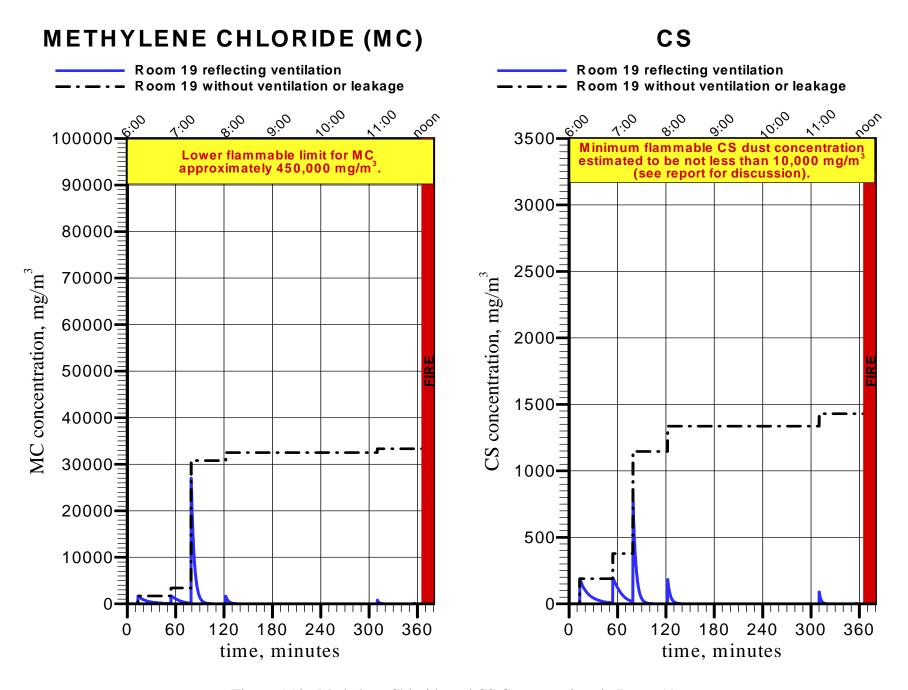


Figure 5.12. Methylene Chloride and CS Concentrations in Room 19

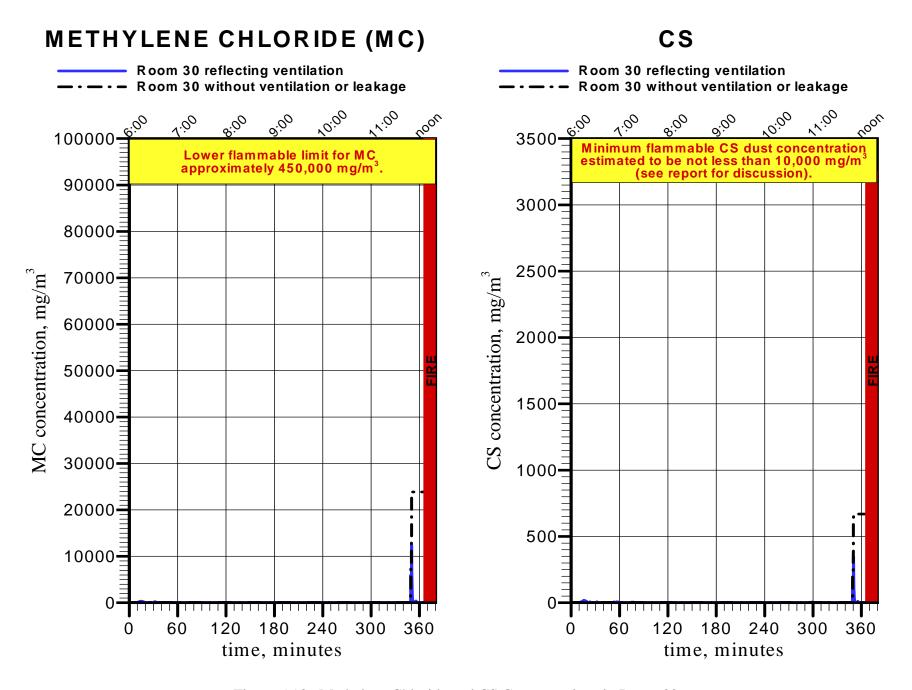


Figure 5.13. Methylene Chloride and CS Concentrations in Room 30

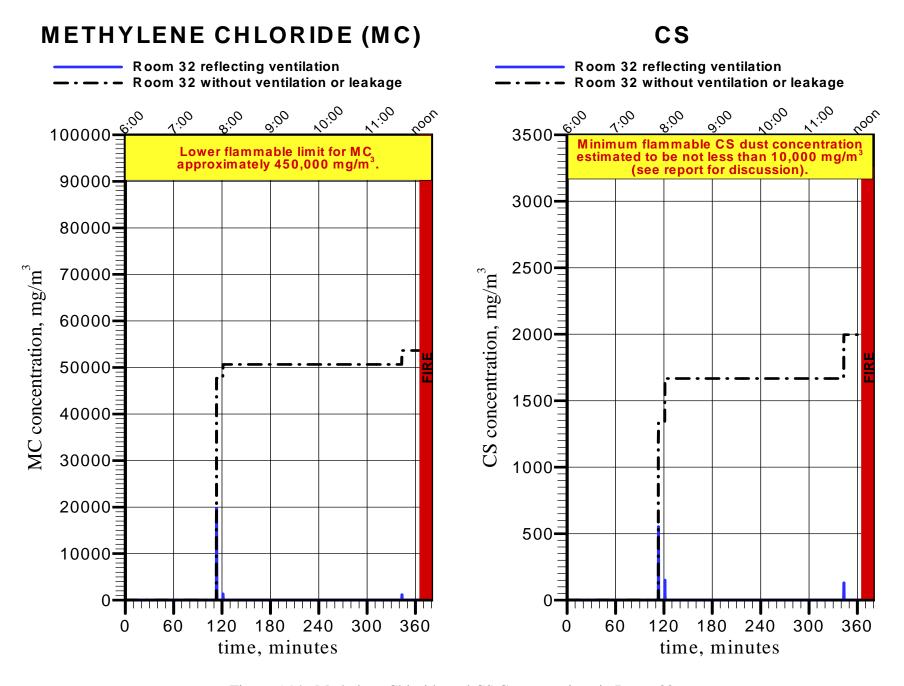


Figure 5.14. Methylene Chloride and CS Concentrations in Room 32

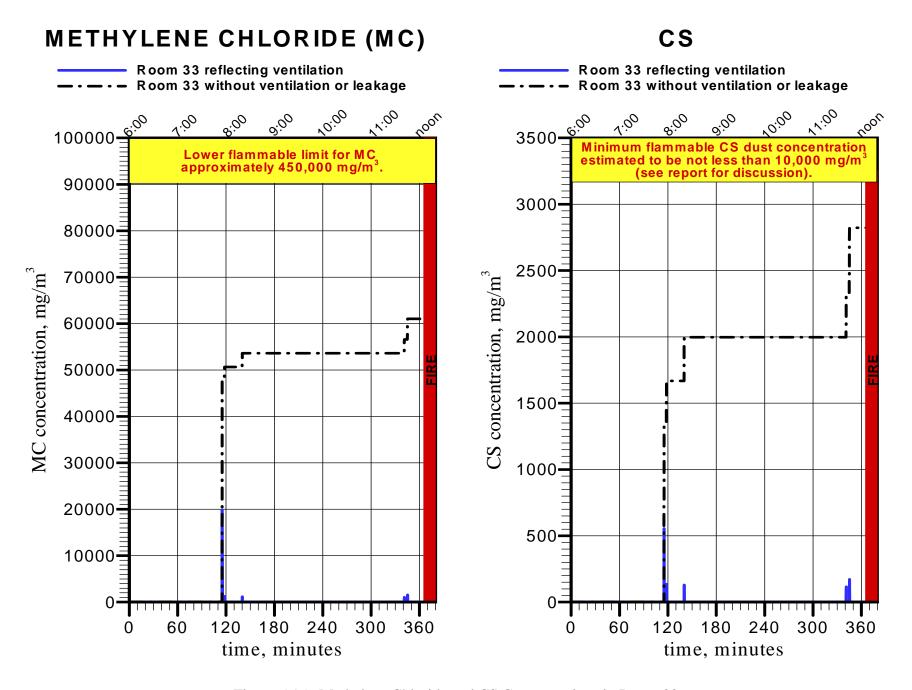


Figure 5.15. Methylene Chloride and CS Concentrations in Room 33

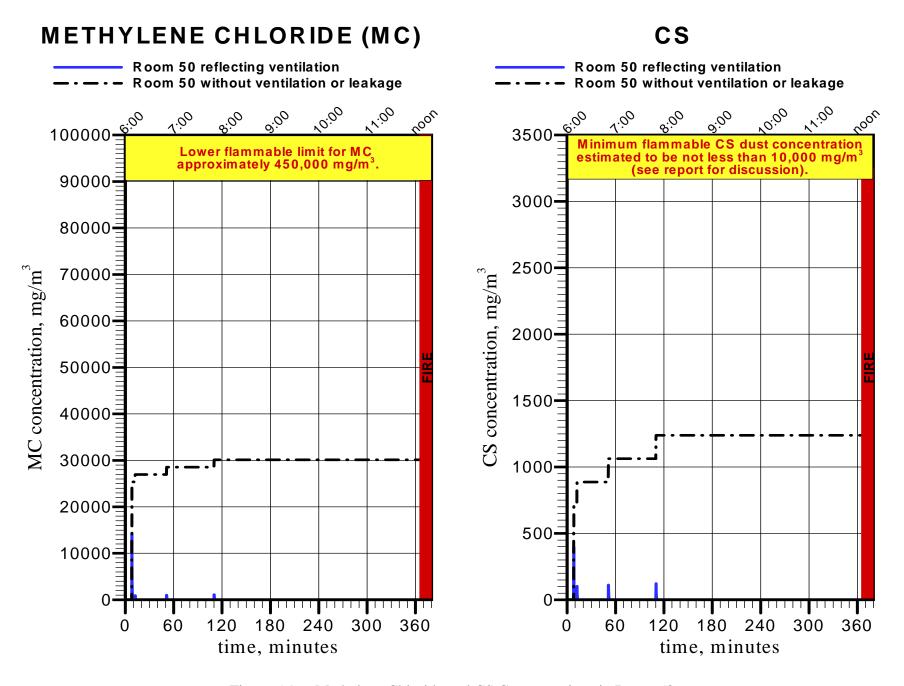


Figure 5.16. Methylene Chloride and CS Concentrations in Room 50

6 ASSESSMENT OF FLAMMABILITY HAZARDS

There have been numerous attempts to estimate the concentrations of CS and or methylene chloride inside the Branch Davidian Complex on April 19, 1993. These prior attempts uniformly assumed the insertion of a given amount of CS or methylene chloride (typically an assumed value for the contents of the tear gas device) into a space with a specified volume (typically, an assumed value, such as 10 m^3 , which might be characteristic of one of the smaller rooms in the Complex). Division of the amount of material by the volume of the room gives the estimated concentration (expressed here as milligrams per cubic meter (mg/m³).

This method of concentration analysis assumes that the space into which the material is deposited is sealed and there are no means for its escape from that space. In reality, the compartments (rooms, stairways, and halls) of the Complex all had openings through which air flowed, thus diluting the tear gas. Section 5 of this report described the estimation of the ventilation, i.e. the flow of air throughout the Complex, and the resulting effect upon the concentration of the tear gas throughout the building. Direct comparison of the concentrations that actually occurred with those that reflect the assumption of no ventilation or leakage (as described above) indicated the critical importance of accounting for the ventilation of the building and the resulting airflows throughout the Complex (Figures 5.7 - 5.16).

For both methods of delivery of tear gas into the Branch Davidian Complex (Ferrets and Model 5 Protectojets) the CS was dissolved in methylene chloride in order to effect delivery of the tear gas in the form of an aerosol.

Each Ferret contained 33.25 grams of methylene chloride and 3.7 grams of CS. The Ferrets produced aerosol droplets by the high shear forces imposed on the liquid when the Ferret impacted a solid surface in the Complex. Since the characteristic of such impacts are highly variable, it is possible that in some cases the surfaces struck by the Ferret could have been wetted by the liquid, and in others that the Ferret did not break or deploy its contents. For purposes of this analysis, I assumed that every Ferret fired at the Complex hit and deployed in its intended target room.

The Model 5 Protectojet ejected a mixture of methylene chloride and (dissolved) CS using pressurized carbon dioxide as a propellent. A Model 5 Protectojet canister contained 1070 grams of methylene chloride, 30 grams of CS, and 700 grams of carbon dioxide. The Model 5 produced aerosol droplets by the high shearing forces exerted on the liquid as it was ejected under high pressure (the vapor pressure exerted by the liquid carbon dioxide) through the small orifice and outlet tube. It is also possible that if the jet (cloud) from the Model 5 directly impacted a solid surface in the Complex some of the liquid could be deposited on, and wet, the surface.

Consequently, methylene chloride could have been present at some time as liquid and/or vapor. Conversely, the CS was not present as a vapor because the temperatures achieved during placement in the Complex were not sufficiently high. For the concentrations of CS in methylene chloride in the Ferrets and the Model 5 Protectojets, it is justified to assume that the dissolved CS

did not affect the flammability properties of the methylene chloride in which it was dissolved. When the methylene chloride evaporated, the CS was suspended in the air, or deposited on surfaces in the Complex, in the form of very small solid particles (solid aerosol or dust).

It follows that assessment of the flammability hazard of the tear gas placed in the Complex requires consideration of the flammability properties of methylene chloride in the liquid and vapor forms and of the flammability properties of CS in solid (dust) form.

6.1 Methylene Chloride

Methylene chloride is a liquid at normal (ambient) temperatures. The liquid must be vaporized to form a gas, and it must be mixed with a sufficient amount of air before it can burn (react with the oxygen in the air). The lowest temperature of a liquid over which a flammable (capable of being ignited) vapor/air mixture exists is the liquid's *flashpoint*. The flashpoint is normally determined using a standard apparatus in which the liquid is heated in an enclosed container, or cup, and a small, non-luminous, pilot flame is introduced into the vapor space at frequent intervals through a port which is opened and closed automatically by a shutter. The flashpoint is taken as the lowest temperature of the liquid at which the vapor/air mixture ignites.

Classification of *flammable* liquids is usually based on the value of the liquid's flashpoint - the lower the flashpoint the greater the flammability. When methylene chloride is tested for flashpoint, with any of the several methods available, ignition of the vapor/air mixture over the "cup" does not consistently occur. Consequently, the flashpoint is reported as *None*. This does not mean that the methylene chloride will not burn. However, the negative test result does indicate that the liquid does not readily form ignitable vapor/air mixtures over its surface at moderate temperatures. That property is important to the assessment of the flammability of methylene chloride that may have existed as a liquid deposited on solid surfaces in the Complex. It can be concluded, therefore, that any methylene chloride that deposited, by "splashing" or any other method of deposition of the liquid on solid surfaces, would have to be heated in some manner well above the ambient temperatures in the Complex to be ignited.

The amount of liquid that might have been deposited on a surface by an impacting Ferret would not be expected to evaporate rapidly enough to form an ignitable vapor/air mixture over the surface. As will be shown below, the jet cloud ejected from the Model 5 Protectojet was cooled substantially (more that 40 C). Consequently, any liquid that might have been deposited on a surface by direct impact of the jet cloud from the Model 5 Protectojet would not be expected to evaporate rapidly enough to form a flammable vapor/air mixture over the surface.

For methylene chloride vapor to be flammable (capable of being ignited) it must be mixed with air in sufficient amounts to achieve the *lower flammable limit (LFL)* concentration. The LFL concentration of methylene chloride in air (at ambient temperatures) is variously reported to be between 12% and 14% (by gas volume). I have converted the lower value, 12%, to its equivalent value of approximately 450,000 mg/m³. Figures 5.7 - 5.16 clearly indicate that the room-average concentrations of methylene chloride that occurred were far below the concentration required to support combustion. In fact, the same figures show that <u>even in the</u>

<u>absence of any ventilation</u> the concentrations would never have exceeded about 20% of the lower flammable limit concentration which would support combustion.

6.1.1 Contribution of Methylene Chloride to Cause of Fire

Because the concentrations in air of methylene chloride could not have been sufficient (locally) to support combustion, and because the methylene chloride that might have deposited as a liquid on the surfaces in the Complex could not have achieved temperatures sufficient to allow its ignition, the methylene chloride could not have caused the fire.

6.1.2 Contribution of Methylene Chloride to Spread of Fire

Because the local concentrations of methylene chloride in air throughout the Complex were insufficient to support combustion, and because possible methylene chloride accumulations as liquid on surfaces in the Complex were not at sufficiently high temperature to allow ignition, the methylene chloride could not have materially contributed to the spread of the fire.

6.2 Orthochlorobenzylidenemalononitrile (CS)

With either method of tear gas introduction, after the methylene chloride evaporated, solid CS remained in the form of small particles, either suspended in the air or deposited on the surfaces in the Complex. At the (ambient) temperatures that prevailed in the Complex, there would have been no CS present in either liquid or vapor form. It follows that assessment of the fire hazard posed by the presence of CS in the Complex requires consideration of the flammability properties of the CS dust suspended in the air or deposited as layers of dust on the surfaces in the Complex.

The lower limit of flammability of CS dispersed as a solid material in air was not found in the literature. However, minimum values of flammable dust concentrations of the most flammable of dusts do not appear to be less than 10,000 - 20,000 mg/m³ (Hinds, 1999). Figures 5.7 - 5.16 clearly indicate that the room-average concentrations of CS that occurred were far below the concentration required to support combustion. In fact, the same figures show that even in the absence of any ventilation the concentrations would never have exceeded about 30% of the lower flammable limit concentration which would support combustion.

Any CS dust deposited in the Complex would have resulted in very shallow, thin layers, because of the small amounts of CS placed in the individual compartments. The largest (potential) concentration of CS placed in any one room in the Complex was in Room 5 (See Figure 4.1) where two Model 5 Canisters and 4 Ferrets were discharged, totaling approximately 75 grams CS. The floor surface area in Room 5 was approximately 10 square meters. Assuming half (which is unlikely) of the CS deposited uniformly on only one square meter of the floor (also, exceedingly unlikely), the average depth of the CS layer, assuming the bulk density of CS dust to be 0.25 g/cc, would be less than one-fifth of a millimeter (0.2 mm). At the (ambient) temperatures which prevailed in the Complex, such layers could not be ignited.

Summarizing, CS dust might have been suspended in the air in the Complex in two ways:

- ! The CS could have been entrained, due to its small particle size, in the turbulent flows of air caused by the high winds impacting (and ventilating) the building.
- ! CS which might have settled to the floor or other solid surfaces in the Complex could have been resuspended by movements of personnel, or by other mechanical actions.

It was shown in Section 5 that the room-average concentrations of suspended CS that might have possibly occurred throughout the Complex were not sufficient to support its combustion. Furthermore, the extremely small amounts of CS involved (in layers) were not sufficient (in quantity) to have been resuspended so as to cause local CS dust concentrations in the air sufficient to support its combustion.

6.2.1 Contribution of CS to Cause of Fire

Because the concentrations in air of CS solid (dust) could not have been sufficient (locally) to support combustion, the CS could not have ignited, and therefore could not have caused the fire.

6.2.2 Contribution of CS to Spread of Fire

Because the local concentrations of CS in air throughout the Complex were insufficient to support combustion, and because possible CS dust accumulations on surfaces in the Complex were not sufficiently large, and were not sufficiently high temperature, to be ignited, the CS could not have materially contributed to the spread of the fire.

6.3 Analysis of Model 5 Protectojet Cloud Entering the Complex

The Model 5 Protectojet tear gas dispensers delivered (per charge) approximately 1070 grams of methylene chloride, 30 grams of CS (dissolved in the methylene chloride), and 700 grams carbon dioxide (used as the propellent) in a period of approximately 15 seconds. I had determined that the Ferret rounds ruptured upon impact with a solid surface, thereby releasing, effectively instantaneously, their contents with considerable forces which acted to throw the contents away from the device, thus ensuring effective mixing throughout the space where the Ferret ruptured. However, the tear gas was ejected from the Model 5 Protectojet through a small orifice and tube, forming a high velocity jet which produced the desired aerosol cloud, and I considered it necessary to determine whether the Model 5 Protectojets could have created a short term, local region of concentration of methylene chloride (in air) that could have been ignited had it contacted a sufficiently energetic ignition source (such as a lighted Coleman lantern). As a result, I informed the Office of Special Counsel that I wanted to explore this possibility, and they agreed. The Office of Special Counsel obtained for me, and I examined, the two Model 5 Protectojet tear gas dispensers used by the U.S. Government on April 19, 1993, at the Branch Davidian Complex. I investigated whether the methylene chloride in the jet could form

flammable mixtures (12% - 22% methylene chloride by volume) with air entrained into the jet.

The following photograph shows the two Model 5 Protectojets I examined. One of the Protectojets is shown in the condition in which I received it, and the other is shown partially disassembled. I disassembled the (second) Protectojet to determine the sizes of the orifice and discharge tube in order to develop an opinion on the (flammability) characteristics of the jet (cloud) that was ejected into the Complex.



I performed thermodynamic analyses which showed that the jet of methylene chloride, CS, and carbon dioxide exited the canister at temperatures about 40 C below the ambient temperature. At such temperatures, the methylene chloride vapor pressure is so low that maximum methylene chloride vapor concentrations would be less than one-half the lower flammable limit concentration (12%). This means that the methylene chloride (vapor) concentration in the jet could not have been flammable in the short period immediately following its exit from the Protectojet. Furthermore, thermodynamic analysis indicated that even though additional air mixed with the tear gas jet cloud, and additional methylene chloride evaporated from the (suspended) liquid droplets into the vapor phase (as the jet length increased), the maximum methylene chloride vapor concentrations would have always remained less than one-half the lower flammable limit concentration (due to the air addition). This means that the jet-

cloud which issued from the Protectojets never achieved methylene chloride vapor concentrations (in air) sufficient to be ignited. Consequently, I determined that the tear gas jet cloud that issued from the Model 5 Protectojet canisters could not have been ignited by contact with ignition sources which may have been present in the Complex.

6.4 Consideration of Other Expert Opinions

I have attempted in this investigation to explain any differences between my own findings, and those of other experts, on the questions about whether methylene chloride or CS were the cause of, or materially contributed to, the fire at the Branch Davidian Complex on April 19, 1993.

The Office of Special Counsel provided me reports, in voluminous detail, of numerous experts who have considered this matter. There appeared to me to be a consensus, among all experts whose opinions I reviewed, that answers to these questions required realistic quantification of the concentrations of the tear gas components in the Complex in order to determine whether sufficient concentrations were present that could have been ignited by sources of energy present in the Complex.

In my opinion, realistic and accurate estimation of the concentrations of CS and methylene chloride that occurred in the Complex on April 19, 1993, could not be accomplished without careful consideration of the effects of the ventilation of the Complex by the strong wind that was blowing during the entire morning. The Office of Special Counsel supported my efforts to identify, test, and implement a technique to estimate the effect of the wind-driven ventilation on the concentrations of tear gas in the Complex. In that respect, particularly, I believe I have enjoyed an advantage over those experts who have gone before me in this matter.

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7 THE BLEVE OBSERVED IN THE VICINITY OF THE BUNKER

At 12:26 p.m., a large fireball/explosion occurred during the fire which destroyed the Branch Davidian Complex. The fireball was recorded by several video cameras. The fireball occurred near the Complex's "bunker" which was situated below the central tower (See Figure 5.5). There have been suggestions that the event might have been associated with the detonation of high explosive material.

My review of several video recordings indicated immediately to me that the fireball was caused by a boiling liquid expanding vapor explosion (BLEVE). The first two pictures below (clockwise order) illustrate the characteristic features of BLEVES. The first is a picture of an (extensively studied, accidental) BLEVE of a railcar containing propane in Crescent City, Illinois, in 1970. The second is a picture of the (intentional, test) BLEVE of a small tank containing liquefied petroleum gas (LPG) taken in a research program at Queen's University in Ontario, Canada. These pictures indicate the characteristic shape and size of fireballs resulting from BLEVES of LPG containers ranging in size from a few gallons to approximately 10,000 gallons. The third and fourth pictures, respectively, are a video frame from television coverage and an aerial photograph of the Branch Davidian Complex fire on April 19, 1993.









BLEVES occur when compressed flammable gases, such as propane, are exposed to severe heating from fire which causes the tank to fail catastrophically. The tank contents are then released (essentially instantaneously) to the atmosphere. The pressurized contents partially vaporize and expand from the failed tank to form a liquid aerosol cloud which is then ignited by the fire that caused the tank failure. The characteristics of such an event are fundamentally different from the *detonation* of a high explosive material, the latter exhibiting burning (reaction) rates many times faster than the BLEVE, whose burning rates are classified as a *deflagration*.

The phenomenology of BLEVES has been studied extensively, and predictive methods have been developed and tested with which the fireball characteristics size and duration can be predicted given only the amount and identification of the pressurized gas contained in the tank.

I analyzed several video recordings of the fireball to estimate its maximum size and its duration (See Figure 7.1). The analysis indicated the maximum fireball size was approximately 20 meters and the duration was approximately 1.5 seconds. I used correlations available in the scientific literature (Center of Chemical Process Safety, 1994) to determine that the fireball size and duration were consistent with the release of approximately 35 - 40 kilograms of propane (See Figure 7.2).

Finally, the Office of Special Counsel provided photographs of, and dimensions of, a failed LPG tank (shown at right) which was found in the vicinity of the location where the fireball was observed. The failure of the tank near its top is characteristic of BLEVES of such containers because the highest temperatures of the metal are achieved in these areas (due to the absence of liquid on the inside wall surface), and because weak points in the structure typically occur at the welded seams and where penetrations (i.e. tank outlets) occur. I used the actual dimensions of the tank to calculate the volume of the tank (before rupture), and I determined that the maximum liquid contents of the tank (assumed to be propane) would have been about 62 kilograms. Consequently, the size and duration of the fireball that was observed are entirely consistent with the amounts of propane that could have been released from this tank.

Based on the foregoing analysis, I concluded that the fireball/explosion observed at 12:26 p.m. on April 19, 1993, at the Branch Davidian Complex was a BLEVE of the contents of the tank whose remains were found at the site.



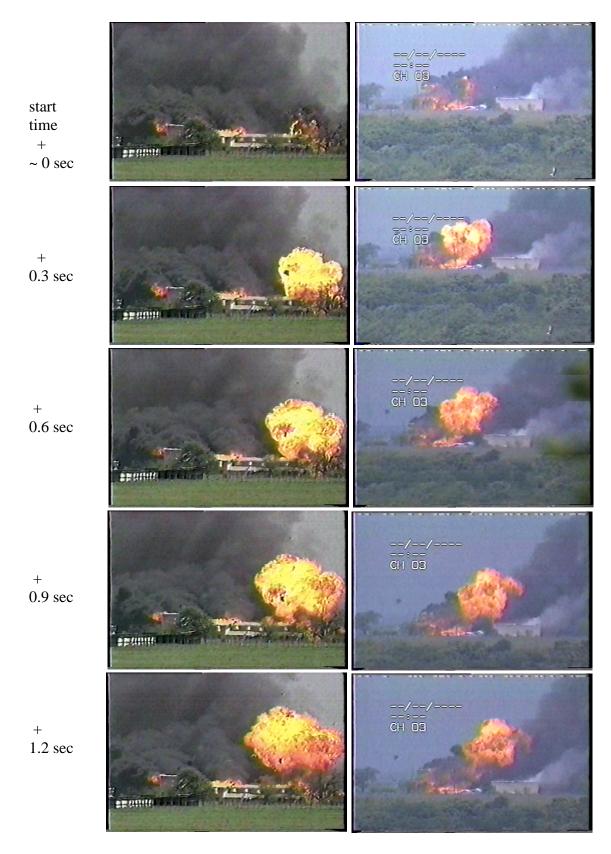


Figure 7.1. Illustration of BLEVE Development from Two Camera Positions

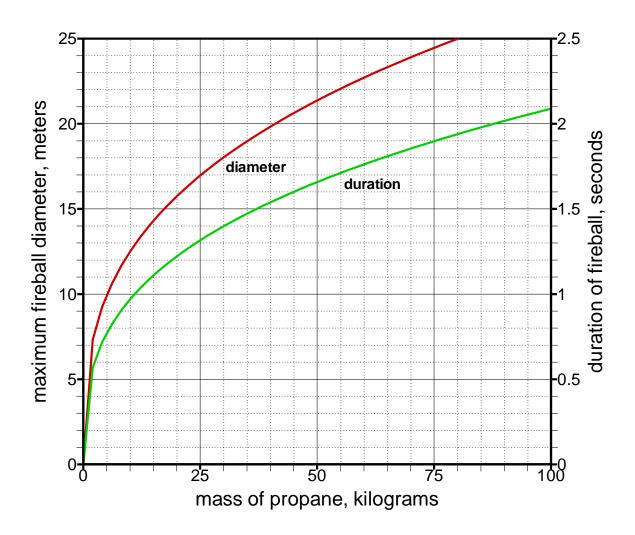


Figure 7.2. Prediction of Fireball Diameter and Duration

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8 CONCLUSIONS

8.1 Background

On September 9, 1999, the Attorney General of the United States appointed Senator John C. Danforth to investigate certain events that occurred at the Branch Davidian Complex near Waco, Texas on April 19, 1993. Senator Danforth established the Office of Special Counsel to carry out the investigation. In early December 1999, I was retained by the Office of Special Counsel to investigate the use of tear gas at the Branch Davidian Complex on April 19, 1993, and, subsequently, to investigate the explosion/fireball which was observed during the fire.

8.2 Tasks

I was tasked to determine:

- ! Whether the tear agents placed in the Complex caused the fire which destroyed the Complex,
- ! Whether the tear agents placed in the Complex importantly contributed to the fire spread, and
- ! The origin and cause of the explosion/fireball that was observed during the destruction of the Complex.

8.3 Analysis

I identified the pertinent flammability characteristics of the components of the tear gas used in the Complex, methylene chloride and CS. I analyzed the amounts, schedule, and location of placement of all of the tear gas that was placed in the Complex on April 19, 1993, and I calculated the physical states (solid, liquid, vapor) and the temperatures and concentrations of methylene chloride and CS which could have occurred throughout the Complex on that date. I analyzed video recordings of the explosion/fireball to determine its maximum size and duration in order to explain its origin and cause.

8.4 Cause of the Fire

I conclude that the tear gas, which contained methylene chloride and CS, as used in the Branch Davidian Complex, did not cause the fire.

8.5 Spread of the Fire

I conclude that the tear gas, which contained methylene chloride and CS, as used in the Branch Davidian Complex, did not materially contribute to the spread of the fire.

8.6 The Explosion/Fireball

I conclude that the explosion/fireball observed at 12:26 p.m. during the Branch Davidian Complex fire was a boiling liquid expanding vapor explosion (BLEVE) which resulted from the rupture, due to fire exposure, of a liquefied petroleum gas (LPG) tank. I also conclude that the fireball observed was consistent with that formed by the BLEVE of a quantity of propane that could have been contained in the ruptured tank found at the Complex.

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Appendix A

Brief Resume --- Dr. Jerry Havens

Dr. Havens is Distinguished Professor of Chemical Engineering at the University of Arkansas, where he teaches thermodynamics and mass, energy, and momentum transport phenomena. Dr. Havens is also Director of the University of Arkansas Chemical Hazards Research Center, which conducts major research programs to develop mathematical and windtunnel modeling methods for atmospheric dispersion of hazardous chemicals. He received his Bachelor of Science, Master of Science, and Doctor of Philosophy Degrees from the Universities of Arkansas (1961), Colorado (1962), and Oklahoma (1969), respectively. He has industrial experience with the Phillips Petroleum and Procter and Gamble Companies and served as an officer in the U.S. Army Chemical Corps. Dr. Havens' primary research interests are in nuclear, biological and chemical hazard assessment, with particular emphasis on atmospheric dispersion of hazardous gases and fire and explosion phenomena. He is internationally recognized as an expert in methodologies for predicting atmospheric dispersion of intentional or accidental releases of hazardous, denser-than-air gases, and the assessment of toxicity and fire hazards which result therefrom. At the University of Arkansas, Dr. Havens has conducted research to develop mathematical models for heavy gas dispersion for the U.S. Coast Guard (U.S. Department of Transportation) and the U.S. Environmental Protection Agency and is currently developing LNG vapor dispersion simulation methods for regulatory application for the Gas Research Institute. Dr. Havens has testified in government Marine Boards of Investigation into major marine shipping accidents involving hazardous materials and has published comprehensive reviews and assessments of techniques used to predict vapor dispersion from accidental spills of LNG as well as many other hazardous materials which produce flammability or toxicity hazards.

Dr. Havens joined the University of Arkansas in 1970. While on sabbatical leave in 1976-77, he served as full-time Technical Advisor to the Office of Merchant Marine Safety, U.S. Coast Guard, Washington, DC. He was technical advisor to the British Health and Safety Executive for the conduct of the Thorney Island Heavy Gas Trials in southern England in 1982. In October 1993 and again in 1994 he served on the Research Proposal Review Board of the Commission of European Communities Research and Development Directorate. In January 1994, Dr. Havens, serving as scientific advisor on gas dispersion, accompanied the International Medical Commission on Bhopal to Bhopal, India, to conduct epidemiological studies to determine health effects remaining there as a result of the catastrophic release of methyl isocyanate which occurred on December 3, 1984. He served in 1997-98 as a member of the SCOPE (Safety Controls Optimization by Performance Evaluation) panel for quantifying controls for reducing toxicity and flammable gas risks at the Hanford, Washington, radioactive waste tanks. Dr. Havens is currently a member of the Working Group on Destruction of Chemical Weapons of the Organization for the Prevention of Chemical Weapons (OPCW) Scientific Advisory Board. He also serves on the NOAA/National Ocean Service program review panel, on the International Editorial Board of the Institution of Chemical Engineering (Europe) journal, and the International Editorial Board of the Journal of Hazardous Materials. Dr. Havens is a registered professional engineer and holds memberships in the American Institute of Chemical Engineers, Sigma Xi, and the American Chemical Society. He has served as consultant to numerous U.S. and international government agencies and industries and has published extensively in technical and scientific journals on the subjects of chemical hazards consequence and risk analysis.

Resume --- Dr. Jerry A. Havens

ADDRESS

Office: University of Arkansas

Chemical Hazards Research Center Engineering Research Center Engineering Research Blvd. Fayetteville AR 72701 (501) 575-5381 (501) 575-8718 (fax)

E-mail: jah@engr.uark.edu

Home: 809 Lighton Trail Fayetteville AR 72701 (501) 443-7722

AREAS OF EXPERTISE

Atmospheric dispersion of heavy gases; fire and explosion hazard assessment; nuclear, biological, chemical hazard assessment.

EDUCATION

BSChE, University of Arkansas, 1961 MSChE, University of Colorado, 1962 PhDChE, University of Oklahoma, 1969

Dr. Havens is Distinguished Professor of Chemical Engineering at the University of Arkansas where he has been on the faculty since 1970; he is also Director of the U of A Chemical Hazards Research Center. He has industrial experience with the Phillips Petroleum and Procter and Gamble Companies and served as an officer in the U.S. Army Chemical Corps; he is a registered professional engineer.

Dr. Havens' primary research interests are in atmospheric dispersion of heavy gases and fire/explosion phenomena. He is internationally recognized as an expert in methodologies for predicting atmospheric dispersion of hazardous, denser-than-air gases. He served as full-time Technical Advisor to the Office of Merchant Marine Safety, U.S. Coast Guard, Washington, DC, and he was technical advisor to the (British) National Maritime Institute in the conduct of the Thorney Island Heavy Gas Trials in England in 1982. Dr. Havens has testified in Marine Boards of Investigation into major marine shipping accidents involving hazardous materials and has published comprehensive reviews and assessments of techniques used to predict vapor dispersion from accidental spills of LNG. He served in 1997-98 as a member of the SCOPE (Safety Controls Optimization by Performance Evaluation) panel for quantifying controls for reducing flammable gas risks at the Hanford, Washington, waste tanks; and he currently serves as a member of the Working Group on Destruction of Chemical Weapons of the Organization for the Prevention of Chemical Weapons Scientific Advisory Board.

He has served as consultant to numerous U.S. and international government agencies and industries, including

U.S. Army Ballistic Research Laboratory

U.S. Air Force Scientific Advisory Board

U.S. Coast Guard

U.S. Department of Energy

U.S. Environmental Protection Agency

U.S. Transportation Safety Board

National Academy of Sciences

National Manufacturers Association

Chemical Manufacturers Association

The Exxon Company

The Mobil Company

The Dow Chemical Company
The Olin Corporation
British Petroleum
British Gas
The Battelle Institute
British Health and Safety Executive
South Coast Air Quality Management District (California)

At the University of Arkansas Dr. Havens conducts a dense gas dispersion research program which has received approximately \$8 million in funding. He has conducted research to develop mathematical models for heavy gas dispersion for the U.S. Coast Guard and is currently evaluating three-dimensional hydrodynamic computer code models for LNG vapor dispersion for the Gas Research Institute (USA) and developing LNG vapor dispersion simulation methods for regulatory application for the Gas Research Institute.

The Arkansas State Board of Higher Education chose Dr. Havens to receive their first Award for Excellence in Research (1988).

In October 1993 and again in 1994 he was invited by the Commission of European Communities Research and Development Directorate to serve on their Research Proposal Review Board. The International Medical Commission on Bhopal invited Dr. Havens in January 1994 to be the only non-medical doctor on a 16-member team representing 14 countries; the Commission spent two weeks in Bhopal studying the Bhopal MIC release disaster. Dr. Havens also serves on the NOAA/National Ocean Service program review panel, on the International Editorial Board of the Institution of Chemical Engineering (Europe) journal, and the International Editorial Board of the Journal of Hazardous Materials.

Dr. Havens is a registered professional engineer and holds memberships in the American Institute of Chemical Engineers, Sigma Xi, and the American Chemical Society.

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Havens, J. A., "Risks in Marine Bulk Transport of Liquefied Natural Gas," National Academy of Sciences, Washington, DC, February 1978.

- Havens, J. A., "Vapor Dispersion from Catastrophic LNG Spills onto Water," invited presentation, Illinois Institute of Technology, Chicago, Illinois, February 1978.
- Havens, J. A., "Heavy Gas Dispersion Model Development," American Gas Association Gas Transmission Conference, Montreal, Canada, May 1978.
- Havens, J. A., "Atmospheric Dispersion of Flammable Gas Following Catastrophic LNG Spills on Water," Fifth International Symposium on Transport of Dangerous Goods by Sea and Inland Waterway, Hamburg, Germany, April 1978.
- Havens, J. A., "A Computational Evaluation of the SIGMET LNG Vapor Dispersion Model," Sixth International Symposium on Transport of Dangerous Goods by Sea and Inland Waterway, Tokyo, Japan, October 1980.
- Havens, J. A., "Heavy Gas Dispersion Model Development," invited presentation, Kanazawa University, Kanazawa, Japan, October 1980.
- Havens, J. A., "Comparison of Heavy Gas Dispersion Models," Twelfth International Technical Meeting on Air Pollution Modeling and its Applications, Menlo Park, California, August 1981.
- Havens, J. A., "Heavy Gas Dispersion Model Development," invited presentation, von Karman Institute, Rhode Saint Genese, Belgium, March 1982.
- Havens, J. A., "LNG Vapor Dispersion--A Review," invited presentation, Trondheim University, Trondheim, Norway, March 1982.
- Havens, J. A., "Review of Predictive Models for LNG Vapor Dispersion," GRI/MIT LNG Safety Research Workshop, Massachusetts Institute of Technology, Cambridge, Massachusetts, March 1982.
- Havens, J. A., "A Review of Mathematical Models for Heavy Gas Dispersion," invited presentation, Manchester University, Manchester, England, April 1982.
- Havens, J. A., "Risks of Accidental Flammable Gas Releases," OYEZ International Symposium on Risk Assessment, London, England, June 1982.
- Havens, J. A., "State of the Art in Heavy Gas Dispersion Modeling," invited lecture, Trans-Canada Pipeline Company, Toronto, Canada, May 1982.
- Havens, J. A., "Experimental Heavy Gas Dispersion Research," invited presentation, Oklahoma State University, Stillwater, Oklahoma, March 1983.
- Havens, J. A., "An Experimental Study of Gravity Spreading and Air Entrainment by Heavy Gas Instantaneously Released in a Calm Atmosphere," invited presentation, Delft University, Delft, Holland, September 1983.
- Havens, J. A., "Heavy Gas Dispersion Research at the University of Arkansas," invited presentation, University of Tulsa, Tulsa, Oklahoma, March 1984.
- Spicer, T. O. and J. A. Havens, "Modeling the Thorney Island Trials," Symposium on the Thorney Island Phase I Trials, Sheffield, England, April 1984.
- Havens, J. A., et al., "Development and Experimental Verification of HACS Model for Chemical Spills in Waterways," Proceedings, 1984 Hazardous Materials Spills Conference, Nashville, Tennessee, April 1984.
- Havens, J. A., "Development of a Heavy Gas Dispersion Model for the U.S. Coast Guard Hazard Computer Systems," Third International Symposium on Heavy Gases and Risk Assessment, Bonn, Germany, November 1984.
- Havens, J. A., "Heavy Gas Dispersion Modeling--Application to LNG/LPG Safety," sponsored by the Atmospheric

- Environment Services of Canada, Toronto, Canada, January 1985.
- Havens, J. A., "Atmospheric Dispersion of Heavy Gases: An Update," Third International Symposium on Risk Assessment in the Process Industries, University of Manchester, England, April 1985.
- Havens, J. A., "Review of Atmospheric Dispersion Models for Hazardous Heavy Gases," Symposium on Catastrophic Gas Releases, National Manufacturers Association, Washington, DC, June 1985.
- Havens, J. A., "Chemical Engineering Research in Heavy Gas Dispersion," Proceedings, 75th Anniversary Symposium of the Arkansas Chemical Industries, 1985.
- Havens, J. A., "On the Rational Assessment of Chemical Hazards," Oxford Lecture Series, University of Arkansas, Fayetteville, Arkansas, February 1986.
- Havens, J. A., "Heavy Gas Dispersion: An Overview," invited presentation, University of Oklahoma, Norman, Oklahoma, April 1986.
- Havens, J. A., Keynote address on dense gas dispersion models, Determination of Atmospheric Dilution for Emergency Preparedness (Joint EPA-DOE Technical Workshop), Research Triangle Park, North Carolina, October 1986.
- Havens, J. A., "Dense Gas Dispersion Modeling: An Overview," invited presentation, Institut fur Aerodynamik, Eidgenossiche Technische Hochschule, Zurich, Switzerland, May 1988.
- Havens, J. A., "Considerations for Dense Gas dispersion Modeling," lectures, American Institute of Chemical Engineers/Center for Chemical Process Safety short courses, Princeton, New Jersey, October 1988, and Houston, Texas, March 1989.
- Havens, J. A., "Modeling Dense Gas Dispersion," invited presentation, Louisiana State University, Baton Rouge, Louisiana, March 1989.
- Havens, J. A., "Dense Gas Dispersion Modeling," invited presentation, Indo-U.S. Workshop on Risk Assessment, New Delhi, India, December 1989.
- Havens, J. A., "An Overview of Dense Gas Dispersion Modeling at the University of Arkansas," invited presentation, Rotary Club, Fayetteville, Arkansas, January 1990.
- Havens, J. A., "An Overview of Dense Gas Dispersion Modeling," American Risk Management workshop, Clearwater Beach, Florida, April 1990.
- Havens, J. A., AIChE/CCPS Continuing Education Short Course, "Atmospheric Dispersion Modeling," Chicago, Illinois, November 1990; Houston, Texas, April 1991; Pittsburgh, Pennsylvania, November 1991; New Orleans, Louisiana, April 1992.
- Havens, J. A., "Field Experimental Research on Dense Gas Dispersion," International Workshop on Hazard Assessment on Disaster Mitigation in Petroleum and Chemical Process Industries, Madras, India, December 1990 (also in Journal of Hazardous Materials).
- Havens, J. A., T. O. Spicer, S. Khajehnajafi, and T. Williams, "Developments in Liquefied Natural Gas Dispersion Modeling," International Conference and Workshop on Mitigating the Consequences of Accidental Releases of Hazardous Materials, New Orleans, Louisiana, May 1991.
- Havens, J. A., "Methods for Dense Gas Dispersion Modeling," Fourth Symposium on Heavy Gases, Bonn, Germany, September 1991.
- Havens, J. A. and H. L. Walker, "A New Push-Through Ultra-Low Speed Boundary Layer Wind Tunnel," 5th EURASAP International Workshop on Wind and Water Tunnel Modelling of Atmospheric Flow and Dispersion, Stevenage, England, October 1991.

- Havens, J. A., "Dense Gas Dispersion Modeling and the DEGADIS Model," invited guest speaker, AIIE training seminars, Richland, Washington, January 1992 and New Orleans, Louisiana, April 1992.
- Havens, J. A., "Dense Gas Dispersion Research at the University of Arkansas," invited presentation, AIChE local chapter meeting, El Dorado, Arkansas, April 1992.
- Havens, J. A. and B. Bauer, "Modeling Dense Gas Releases at Gaz de France," poster session presentation at LNG-10, Kuala Lumpur, Malaysia, May 1992.
- Havens, J. A., "DEGADIS and Dense Gas Dispersion Modeling: Future Emphases," invited guest speaker, US DOE/EPA Science Advisory Board Committee conference, Washington, DC, July 1992.
- Havens, J. A., "Dense Gas dispersion Modeling Research at the University of Arkansas," invited guest speaker, CentraGas conference, Toronto, Ontario, Canada, October 1992.
- Havens, J. A., "Dense Gas Dispersion Modeling with DEGADIS," invited guest speaker, NOAA/CAMEO meeting, Chicago, Illinois, January 1993.
- Havens, J. A., "Dense Gas Dispersion Research in the U.S.," invited presentation, international conference Problem Clouds II, Amsterdam, The Netherlands, April 1993.
- Havens, J. A., "The Role of Dispersion Models in Emergency Response and Community Notification," invited presentation, American Industrial Hygiene Conference and Exposition, New Orleans, Louisiana, May 1993.
- Havens, J. A., "The Use of the DEGADIS Model for Use in Canadian Gas Industries," invited presentation, meeting of Canadian Gas Users' Group, Vancouver, British Columbia, Canada, May 1993.
- Havens, J. A. and H. L. Walker, "A Research Program to Provide Wind-Tunnel Data Sets for the Validation of Mathematical Models for Dense Gas Dispersion in the Presence of Obstacles," 6th EURASAP International Workshop on Wind and Water Tunnel Modelling of Atmospheric Flow and Dispersion, Aso, Kumamoto, Japan, August 1993.
- Havens, J. A., "Dense Gas Dispersion Research in the U.S.," 2nd Conference for European Research in Industrial Fires, Cadarache, France, May 1994.
- Spicer, T. O. and J. A. Havens, "Application of Dispersion Models to Flammable Cloud Analyses," 6th Annual PetroSafe, Houston, Texas, February 1995.
- Walker, H. L., T. Spicer, and J. Havens, live, on-site presentation of wind tunnel research facility, fX network "Breakfast Time," (nationally televised feature program), March 1995.
- Havens, Jerry, Tom Spicer, Heather Walker, and Ted Williams, "Validation of Mathematical Models using Wind-Tunnel Data Sets for Dense Gas Dispersion in the Presence of Obstacles," 8th International Symposium on Loss Prevention and Safety Promotion in the Process Industries, Antwerp, Belgium, June 1995.
- Havens, Jerry, Tom Spicer, Heather Walker, and Ted Williams, "LNG Vapor Dispersion Experiments for Complex Mathematical Model Evaluation," poster session presentation, LNG-11, Birmingham, England, July 1995.
- Havens, Jerry, Tom Spicer, Heather Walker, and Ted Williams, "Regulatory Application of Wind Tunnel Models and Complex Mathematical Models for Simulating Atmospheric Dispersion of LNG Vapor," International Conference and Workshop on Modeling and Mitigating the Consequences of Accidental Releases of Hazardous Materials, New Orleans, Louisiana, September 1995.
- Havens, J. A., "Atmospheric Dispersion of Ammonia Clouds," invited presentation, Ammonia Safety Summit, Ammonia Safety and Training Institute, Watsonville, California, October 8, 1998.

Havens, J. A., "Improvements in Rational Dispersion Modeling for Consequence Assessment," EUROMECH Colloquium 391, Prague, The Czech Republic, September 1999

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Havens, J. A., "U.S. Coast Guard Marine Board Investigation of Fire and Explosion on the Steamship SANSINENA in Los Angeles Harbor, testimony, U.S. Coast Guard Report 16732/71895, 1977.

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Havens, J. A. and T. O. Spicer, "Modification and Extension of LNG Vapor Dispersion Simulation Methods for Regulatory Application," series of reports to Gas Research Institute, GRI Contract No. 5086-252-1287, 1988-present.

Havens, J. A. and T. O. Spicer, "LNG Vapor Dispersion Prediction with the DEGADIS Dense Gas Dispersion Model," Gas Research Institute Report No. 89-0242, 1990.

Havens, J. A. and T. O. Spicer, "Feasibility Assessment of a Conjunctive Modeling Approach for LNG Vapor Dispersion Prediction," Gas Research Institute Report, 1991.

Havens, Jerry, Tom Spicer, and Heather Walker, "Regulatory Application of Wind Tunnel Models and Complex Mathematical Models for Simulating Atmospheric Dispersion of LNG Vapor," Gas Research Institute Report No. 92-0257, August 1994.

Havens, Jerry and Tom Spicer, "LNG Vapor Dispersion Case Analyses for the ENAGAS Company," Topical Report for Gas Research Institute, November 1994.

Havens, Jerry, Heather Walker, and Tom Spicer, "Characterization of the LGFSTF Wind Tunnel in Preparation for

the DOE/EPA Hazardous Chemical Evaporation Rate Experiments," U.S. DPE/EPA Chemical Hazards of Atmospheric Releases Research (CHARR) Program Report, March 1995.

Havens, Jerry, Tom Spicer, and Heather Walker, "Evaluation of Mitigation Methods for Accidental LNG Releases: Volume 1/5--Wind Tunnel Experiments and Mathematical Model Simulations to Study Dispersion of a Vapor Cloud Formed following LNG Spillage into a Diked Area Surrounding a Storage Tank," Topical Report for Gas Research Institute, November 1996.

Havens, Jerry, Tom Spicer, and Heather Walker, "Evaluation of Mitigation Methods for Accidental LNG Releases: Volume 2/5--Wind Tunnel Experiments and Mathematical Model Simulations to Study Heat Transfer from a Flat Surface to a Cold Nitrogen Cloud in a Simulated Atmospheric Boundary Layer," Topical Report for Gas Research Institute, November 1996.

Havens, Jerry, Tom Spicer, and Heather Walker, "Evaluation of Mitigation Methods for Accidental LNG Releases: Volume 3/5--Wind Tunnel Experiments for Mitsubishi Heavy Industries, Ltd.," Topical Report for Gas Research Institute, November 1996.

Havens, Jerry, Tom Spicer, and Heather Walker, "Evaluation of Mitigation Methods for Accidental LNG Releases: Volume 4/5--Wind Tunnel Experiments for Osaka Gas Company," Topical Report for Gas Research Institute, November 1996.

Spicer, Tom, Jerry Havens, and Heather Walker, "Evaluation of Mitigation Methods for Accidental LNG Releases: Volume 5/5--Using FEM3A for LNG Accident Consequence Analysis," Topical Report for Gas Research Institute, April 1997.

Brief Resume --- Dr. Tom Spicer

Dr. Spicer is Professor of Chemical Engineering at the University of Arkansas where he teaches courses on chemical process safety, heat transport, and modeling and computational methods. Dr. Spicer also collaborates in the Chemical Hazards Research Center (CHRC) at the University of Arkansas; the CHRC conducts major research programs to develop and verify mathematical and wind tunnel models of the atmospheric dispersion of hazardous chemicals. He received his Bachelor of Science in Chemical Engineering, Master of Science in Chemical Engineering, and Doctor of Philosophy in Engineering from the University of Arkansas in 1981, 1983, and 1985, respectively. He has industrial experience with Arkansas Eastman Company. Dr. Spicer's primary research interests are in the assessment of hazards from airborne contaminants and from fire and explosion phenomena. He is internationally recognized as an expert in modeling atmospheric releases of airborne contaminants, particularly those which are denser than air. Since joining the faculty of the University of Arkansas in 1985, Dr. Spicer has conducted research and developed mathematical models of denser-than-air contaminant dispersion for the U.S. Coast Guard, U.S. Air Force, U.S.Department of Transportation, and the U.S. Environmental Protection Agency. Present research is directed to developing atmospheric dispersion models for regulatory application to the liquefied natural gas (LNG) industry for the Gas Research Institute. Dr. Spicer is a registered professional engineer and holds memberships in the American Institute of Chemical Engineers and Sigma Xi. He has served as a consultant to numerous governmental agencies and industries, and his work has been published in technical and scientific journals on the subjects of chemical hazard consequences and risk analysis.

Thomas O. Spicer, III

Department of Chemical Engineering, University of Arkansas 3202 Bell Engineering Center, Fayetteville, AR 72701 (501) 575-6516 FAX: (501) 575-7926 email: tos@engr.uark.edu

EDUCATION

PhD, Engineering, University of Arkansas, 1985 MS, Chemical Engineering, University of Arkansas, 1983 BS, Chemical Engineering, University of Arkansas, 1981

PROFESSIONAL EXPERIENCE

Professor, Department of Chemical Engineering, University of Arkansas, 1996 - present

Associate Professor, Department of Chemical Engineering, University of Arkansas, 1988 to 1996

Assistant Professor, Department of Chemical Engineering, University of Arkansas, 1984 to 1988

Graduate Teaching Assistant, Department of Chemical Engineering, University of Arkansas, 1981

Cooperative Education Student, Arkansas Eastman, Batesville, Arkansas, 1978-79

PROFESSIONAL AFFILIATIONS

Air and Waste Management Association American Institute of Chemical Engineers American Society of Engineering Education Omega Chi Epsilon Registered Professional Engineer - Arkansas Sigma Xi Tau Beta Pi

HONORS

Outstanding Co-op Student, University of Arkansas, 1980
Outstanding Senior Undergraduate in Chemical Engineering, American Institute of Chemists Award, University of Arkansas, 1981
Beeler Fellowship, University of Arkansas, 1982-84

SERVICE

Fayetteville Habitat for Humanity, Site Selection and Building Committees; Board of Directors

Cooperative Emergency Outreach, Board of Directors

Chemical Engineering Computing Facility and Use Committee (Chairman)

Chemical Engineering Graduate Studies Committee

College of Engineering Computer Advisory Committee

College of Engineering Academic Ethics Board

ASEE Midwest Section Bylaws Committee

ASEE Midwest Section Meeting Paper Committee

PROFESSIONAL ACTIVITIES

Refereed Journal Articles

- 1. Spicer, T.O., and J.A. Havens, "Modeling the Phase I Thorney Island Experiments," *Journal of Hazardous Materials*, June 1985.
- 2. Havens, J.A., P.J. Schreurs, and T.O. Spicer, "Analysis and Simulation of Thorney Island Trial 34," *Journal of Hazardous Materials*, November 1987.
- 3. Spicer, T.O., and J.A. Havens, "Field Test Validation of the DEGADIS Model," *Journal of Hazardous Materials*, November 1987.
- 4. Havens, J., and T.O. Spicer, "Software Review TECJET: An Atmospheric Dispersion Model," *Risk Analysis*, Vol. 10, No. 3, 1990.
- 5. Hanna, S., P. Chatwin, E. Chikhliwala, R. Londergan, T. Spicer, and J. Weil, "Results from the Model Evaluation Panel," *Plant/Operations Progress*, Vol. 11, No.1, January 1992.
- 6. Havens, J., H. Walker, and T.O. Spicer, "Wind-Tunnel Data Sets for Complex Dispersion Model Evaluation," *Journal of Loss Prevention in the Process Industries*, Vol.7, No.2, 1994.
- 7. Baik, J.H., H. Walker, T.O. Spicer, and J. Havens, "Measurement of Low Velocities in CO₂/Air Mixtures Using Hot-Wire/Film Anemometry," *Process Safety and Environmental Protection: Transactions of the Institution of Chemical Engineers Part B*, Vol. 74, May 1996.
- 8. Spicer, T.O., J.H. Baik, and J. Havens, "Molecular Diffusion Effects on Entrainment in Wind Tunnel Studies of Dense Gas Dispersion," *Process Safety and Environmental Protection: Transactions of the Institution of Chemical Engineers Part B*, Vol. 74, August 1996.
- 9. Spicer, T.O., and J. Havens, "Application of Dispersion Models to Flammable Cloud Analyses," *Journal of Hazardous Materials*, Vol. 49, 1996.

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- 1. Havens, J.A., and T.O. Spicer, "Further Analysis of Catastrophic LNG Spill Vapor Dispersion," *Heavy Gas and Risk Assessment--II*, S. Hartwig (ed.), 1983.
- 2. Havens, J.A., and T.O. Spicer, "Gravity Spreading and Air Entrainment by Heavy Gases Instantaneously Released in a Calm Atmosphere," I.U.T.A.M. Symposium on Atmospheric Dispersion of Heavy Gases and Small Particles, Den Haag, The Netherlands, 1983.
- 3. Spicer, T.O., and J.A. Havens, "Development of a Heavier-than-Air Gas Dispersion Model for the U.S. Coast Guard Hazard Assessment Computer System," *Heavy Gas and Risk Assessment--III*, S. Hartwig (ed.), 1985.
- 4. Spicer, T.O., and J.A. Havens, "Application of a Heavy Gas Dispersion Model to the Prediction of Dispersion of Nitrogen Tetroxide," JANNAF Safety and Environmental Protection Subcommittee Meeting, Monterey, CA, 1985.
- 5. Spicer, T.O., J.A. Havens, P.A. Tebeau, and L.E. Key, "DEGADIS--A Heavier-than-Air Gas Atmospheric Dispersion Model Developed for the U.S. Coast Guard," Air Pollution Control Association Annual Meeting, Minneapolis, MN, 1986.
- 6. Spicer, T.O., and J.A. Havens, "Gravity Flow and Entrainment by Dense Gases Released Instantaneously into Calm Air," Third International Symposium on Stratified Flows, Pasadena, CA, 1987.
- 7. Spicer, T.O., J.A. Havens, and L.E. Key, "Evaluation of the DEGADIS Dispersion Model Using Data from Field Releases of Pressurized Ammonia," Air Pollution Control Association Annual Meeting, New York, NY, 1987.
- 8. Havens, J.A., T.O. Spicer, and P.J. Schreurs, "Evaluation of 3- Dimensional Numerical Atmospheric Dispersion Models," International Conference on Vapor Cloud Modeling, Boston, MA, 1987.
- 9. Havens, J.A., T.O. Spicer, and D.E. Layland, "A Dispersion Model for Elevated Heavy Gas Jet Releases," International Conference on Vapor Cloud Modeling, Boston, MA, 1987.
- 10. Spicer, T.O., J.A. Havens, and L.E. Key, "Extension of DEGADIS for Modeling Aerosol Releases," International Conference on Vapor Cloud Modeling, Boston, MA, 1987.
- 11. Spicer, T.O., J.A. Havens, and L.E. Key, "Uncertainties in the Application of Atmospheric Dispersion Models in the Presence of Jet Releases, Aerosol Releases, or Heterogeneous Surface Roughness," JANNAF Safety and Environmental Protection Subcommittee Meeting, Monterey, CA, 1988.
- Spicer, T.O., and J. Havens, "Modeling HF and NH₃ Spill Test Data Using DEGADIS," 1988 Summer National Meeting of the American Institute of Chemical Engineers, Denver, CO, 1988.
- 13. Spicer, T.O., J. Havens, and D. Guinnup, "A Dispersion Model for Gas Pipeline Accidental Releases," 1989 Spring National Meeting, American Institute of Chemical Engineers, April 1989.
- 14. Havens, J.A., T.O. Spicer, and D. Guinnup, "Extension of the DEGADIS Atmospheric Dispersion Model for Elevated Jet Releases," 6th International Symposium Loss Prevention and Safety Promotion in the Process Industries, Oslo, Norway, June 1989.

- Spicer, T.O., and J. Havens, "Modeling Aerosol Dispersion for Accident Consequence Analyses," 1990 American Institute of Chemical Engineers Spring National Meeting, Orlando, FL. 1990.
- 16. Havens, J., T.O. Spicer, S. Khajehnajafi, and T. Williams, "Developments in Liquefied Natural Gas Dispersion Modeling," International Conference and Workshop on Modeling and Mitigating the Consequences of Accidental Releases of Hazardous Materials, AIChE, New Orleans, LA, May 1991.
- 17. Touma, J.S., D. Guinnup, and T.O. Spicer, "Development of a Guidance Document for the Application of Refined Dispersion Models for Air Toxics Releases," 85th Annual Meeting of the Air and Waste Management Association, Kansas City, MO, June 1992.
- 18. Miller, Billy D., and T.O. Spicer, "Spreading And Vaporization of LNG Spills on Land, American Gas Association Distribution Transmission Conference and Exhibit, Orlando, FL, May 1993.
- Ohba, R., H. Mishima, and T.O. Spicer, "The Calculation of LNG Vapor Dispersion," Japan Society for Aeronautical and Space Sciences (West Branch), Nagasaki, Japan, November 1993.
- 20. Spicer, T.O., and J. Havens, "Application of Dispersion Models to Flammable Cloud Analyses," 6th Annual Petro-Safe, Houston, February 1995.
- 21. Havens, J., T.O. Spicer, H. Walker, and T. Williams, "Validation of Mathematical Models for Dense Gas Dispersion in the Presence of Obstacles using Wind-Tunnel Data Sets," 8th International Symposium on Loss Prevention and Safety Promotion in the Process Industries, Antwerp, Belgium, June 1995.
- 22. Havens, J., T.O. Spicer, H. Walker, and T. Williams, "Regulatory Application of Wind Tunnel Models and Complex Mathematical Models for Simulating Atmospheric Dispersion of LNG Vapor," International Conference and Workshop on Modeling and Mitigating the Consequences of Accidental Releases of Hazardous Materials, New Orleans, September 1995.
- 23. Havens, J., T.O. Spicer, H. Walker, and S. Wiersma, "The Effects of Structures on Large LNG Spills," 1998 Process Plant Safety Symposium, October, 1998.
- 24. Havens, J.A., and T.O. Spicer, "Improvements in Rational Dispersion Modeling for Consequence Assessment," EUROMECH Colloquium 391, Prague, The Czech Republic, September 1999.
- 25. Spicer, T.O., and J.A. Havens, "Description and Analysis of Atmospheric Dispersion Tests Conducted by EPA at the DOE Hazmat Spills Center," International Conference and Workshop on Modeling and Mitigating the Consequences of Accidental Releases of Hazardous Materials, San Francisco, September 1999.
- 26. Havens, J.A., and T.O. Spicer, "Improvements in Rational Dispersion Modeling for Consequence Assessment," Mary Kay O'Connor Process Safety Center Symposium, College Station, Texas, October 1999.

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1. Havens, J.A., and T.O. Spicer, "Analysis of Nitrogen Tetroxide Releases into the Atmosphere--Consideration of Dense Gas Effects," U.S. Coast Guard, Washington, DC, 1983.

- 2. Havens, J.A., and T.O. Spicer, "Development of an Atmospheric Dispersion Model for Heavier-than-Air Gas Mixtures," U.S. Coast Guard Report No. CG-D-23-85, Washington, DC, 1985.
- 3. Spicer, T.O., "Mathematical Modeling and Experimental Investigation of Heavier-than-Air Gas Dispersion in the Atmosphere," Doctoral Dissertation, University of Arkansas, Fayetteville, AR, 1985.
- 4. Spicer, T.O., and J.A. Havens, "Development of Vapor Dispersion Models for Nonneutrally Buoyant Gas Mixtures--Analysis of USAF/N₂O₄ Test Data," USAF Engineering and Services Laboratory, May 1986.
- 5. Spicer, T.O., "Using Different Time Averaging Periods in DEGADIS," Exxon Education Foundation, July 1987.
- 6. Havens, J.A., T.O. Spicer, and P.J. Schreurs, "Evaluation of 3-D Hydrodynamic Computer Models for Prediction of LNG Vapor Dispersion in the Atmosphere," Gas Research Institute Report 5083-252-0788, August 1987.
- 7. Spicer, T.O., and J.A. Havens, "Development of Vapor Dispersion Models for Nonneutrally Buoyant Gas Mixtures--Analysis of USCG/NH₃ Test Data," USAF Engineering and Services Laboratory, October 1988.
- 8. Havens, J.A., and T.O. Spicer, "A Dispersion Model for Elevated Dense Gas Jet Chemical Releases," Environmental Protection Agency, 1988.
- 9. Havens, J.A., and T.O. Spicer, "Review of Phosgene Release Mitigation Methodology and Development of a Mathematical Model for Reactive Spray Curtain Design," Chemical Manufacturer's Assoc., 1988.
- Spicer, T.O., and J.A. Havens, "Users Guide for the DEGADIS 2.1 Dense Gas Dispersion Model," Environmental Protection Agency, Report EPA-450/4-89-019, 1989.
- 11. Spicer, T.O., "Implementation of DEGADIS V2.1 on a Personal Computer," American Petroleum Institute, 1990.
- 12. Havens, J., and T.O. Spicer, "LNG Vapor Dispersion Prediction with the DEGADIS Dense Gas Dispersion Model," Gas Research Institute Report 89/0242, 1990.
- 13. Havens, J.A., and T. Spicer, "Feasiblity Assessment of a Conjunctive Modeling Approach for LNG Vapor Dispersion Prediction," Gas Research Institute Report, 1991.
- 14. Havens, J.A., and T.O. Spicer, "Evaluation of Wind Tunnel Simulation and Complex Mathematical Simulation of LNG Vapor Dispersion," Gas Research Institute Topical Report, 1992.
- 15. Havens, J.A., and T.O. Spicer, "Prediction of LNG Vapor Dispersion with the FEM3A Model for Comparison with Mercure Model Predictions," Gas Research Institute Topical Report, 1992.
- 16. Havens, J., and T.O. Spicer, "A Comparison/Evaluation of DEGADIS and NOAA-DEGADIS," Report to Environmental Protection Agency, 1992.
- 17. Spicer, T.O., "Application of DEGADIS to Example Chemical Release Scenarios," Report to Environmental Protection Agency, 1992.
- 18. Spicer, T.O., "Screening Methods for Consequence Analyses: Release Rate and Dispersion Estimates for Denser-than-Air Gases and Aerosols," Report to Environmental Protection Agency, 1993.
- 19. Havens, J., T.O. Spicer, and H. Walker, "Regulatory Application of Wind Tunnel

- Models and Complex Mathematical Models for Simulating Atmospheric Dispersion of LNG Vapor," Gas Research Institute Topical Report, 1994.
- 20. Havens, J., and T.O. Spicer, "LNG Vapor Dispersion Case Analyses for the ENAGAS Company," Gas Research Institute Topical Report, 1994.
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- 25. Havens, J., T.O. Spicer, and H. Walker, "Evaluation of Mitigation Methods for Accidental LNG Releases: Volume 3/5--Wind Tunnel Experiments for Mitsubishi Heavy Industries, Ltd.," Topical Report for Gas Research Institute, November 1996.
- 26. Havens, J., T.O. Spicer, and H. Walker, "Evaluation of Mitigation Methods for Accidental LNG Releases: Volume 4/5--Wind Tunnel Experiments for Osaka Gas Company," Topical Report for Gas Research Institute, November 1996.
- 27. Spicer, T.O., J. Havens, and H. Walker, "Evaluation of Mitigation Methods for Accidental LNG Releases: Volume 5/5--Using FEM3A for LNG Accident Consequence Analysis," Topical Report for Gas Research Institute, February 1997.

Invited Lectures and Presentations

- 1. Mathematical Modeling and Experimental Investigation of Heavier-than-Air Gas Dispersion in the Atmosphere, Oklahoma State University, Stillwater, OK, April 1985.
- 2. Dispersion Modeling Workshop, Dow Chemical Company, Freeport, TX, March 1987.
- 3. Fundamentals of Denser-than-Air Gas Dispersion, EPA Modeling Workshop for Toxic Air Contaminants, Kansas City, Mo, June 1988; San Francisco, CA, October 1988.
- 4. Model Evaluation Workshop, International Conference and Workshop on Modeling and Mitigating the Consequences of Accidental Releases of Hazardous Materials, New Orleans, May 1991.
- 5. Application of the DEGADIS Dispersion Model to Accidental Releases of Hazardous Chemicals, Los Angeles City Fire Department, Los Angeles, CA, August 1993.
- 6. Boiling and Spreading of LNG Pools, Supplemental Gas Committee American Gas Association Roundtable, New Orleans, March 1994.
- 7. Application of the DEGADIS Dispersion Model to Accidental Releases of Anhydrous

- Ammonia, Joint Gas Research Institute and Fertilizer Institute Workshop, New Orleans, September 1994.
- 8. Validation of FEM3A for Dense Gas Dispersion in the Presence of Obstacles Using Wind-Tunnel Data Sets, Japanese National Committee of LNG Safety Study Meeting, Nagasaki, Japan, June 1995.
- 9. Validation of FEM3A for Dense Gas Dispersion in the Presence of Obstacles Using Wind-Tunnel Data Sets, Mitsubishi Heavy Industries, Ltd., Heat Transfer Laboratory Staff Seminar, Nagasaki, Japan, June 1995.

Presentations

- 1. Application of a Heavy Gas Dispersion Model to the Prediction of Dispersion of Nitrogen Tetroxide, JANNAF Safety and Environmental Protection Subcommittee Meeting, Monterey, CA, November 1985.
- 2. DEGADIS--A Heavier-than-Air Gas Atmospheric Dispersion Model Developed for the U.S. Coast Guard, Air Pollution Control Association Annual Meeting, Minneapolis, MN, June 1986.
- 3. Field Test Validation of the DEGADIS Model, Second Symposium on Heavy Gas Dispersion Trials at Thorney Island, Sheffield, England, September 1986.
- 4. Gravity Flow and Entrainment by Dense Gases Released Instantaneously into Calm Air, Third International Symposium on Stratified Flows, California Institute of Technology, Pasadena, CA, February 1987.
- 5. Evaluation of the DEGADIS Dispersion Model Using Data from Field Releases of Pressurized Ammonia, Air Pollution Control Association Annual Meeting, New York, NY, June 1987.
- 6. Extension of DEGADIS for Modeling Aerosol Releases, International Conference on Vapor Cloud Modeling, Boston, MA, November 1987.
- 7. Uncertainties in the Application of Atmospheric Dispersion Models in the Presence of Jet Releases, Aerosol Releases, or Heterogeneous Surface Roughness, JANNAF Safety and Environmental Protection Subcommittee Meeting, Monterey, CA, 1988.
- 8. Modeling HF and NH₃ Spill Test Data Using DEGADIS, 1988 Summer National Meeting of the American Institute of Chemical Engineers, Denver, CO, 1988.
- 9. A Dispersion Model for Gas Pipeline Accidental Releases, 1989 Spring National Meeting, American Institute of Chemical Engineers, Houston, TX, April 1989.
- 10. Modeling Aerosol Dispersion for Accident Consequences Analyses, 1990 Spring National Meeting of the American Institute of Chemical Engineers, Orlando, FL, 1990.
- 11. DEGADIS Dense Gas Dispersion Model, Gas Research Institute Project Advisors Meeting, Fayetteville, AR, 1990.
- 12. Development of a Guidance Document for the Application of Refined Dispersion Models for Air Toxics Releases, 85th Annual Meeting of the Air and Waste Management Association, Kansas City, MO, June 1992.
- 13. Spreading and Vaporization of LNG Spills on Land, American Gas Association Distribution Transmission Conference and Exhibit, Orlando, FL, May 1993.

- 14. Application of Dispersion Models to Flammable Cloud Analyses, 6th Annual Petro-Safe, Houston, TX, February 1995.
- 15. Description and Analysis of Atmospheric Dispersion Tests Conducted by EPA at the DOE Hazmat Spills Center, International Conference and Workshop on Modeling and Mitigating the Consequences of Accidental Releases of Hazardous Materials, San Francisco, September 1999.

Poster Presentations

- 1. Spicer, T.O. and J.A. Havens, "Gravity Flow and Entrainment by Dense Gases Released Instantaneously into Calm Air," Third International Symposium on Stratified Flows, Pasadena, CA, 1987.
- 2. Havens, J., T. O. Spicer, H. Walker, and T. Williams, "LNG Vapor Dispersion Experiments for Complex Mathematical Model Evaluation," LNG-11; 8th International Conference and Exhibition on LNG, 3-6 July 1995, Birmingham, U.K.

COMIS Source Data

Alternate Case 1

Alternate Case 2

Alternate Case 3

Alternate Case 4

Most Likely Case

NETWORK INTERNATIONAL FORENSIC SCIENCE DIVISION

TITLE III, FLIR TAPE AND FBI VIDEO ANALYSIS

EVENTS AT WACO, TEXAS 19th of APRIL 1993

PREPARED FOR THE OFFICE OF SPECIAL COUNSEL

BY
C M MILLS I.Eng. F.IIE(elec). AM.IAFP
DIRECTOR & SENIOR AUDIO CONSULTANT

TITLE

III, FLIR TAPE AND FBI VIDEO ANALYSIS EVENTS AT WACO, TEXAS - 19th of APRIL 1993

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1. Executive Summary

1.1 On September 9, 1999, United States Attorney General Janet Reno appointed Former United States Senator John C. Danforth to investigate events that occurred at the Branch Davidian complex in Waco Texas on April 19, 1993. Senator Danforth created the Office of Special Counsel (OSC) to carry out this investigation.

- 1.2 On the 20th of January 2000, Network International, and more specifically its Senior Audio/Video consultant was engaged by the OSC to:
 - Review the Audio portions of the April 19, 1993 FLIR video tapes.
 - ♦ Review original April 19, 1993, tapes for evidence of tampering, erasure or alteration (FLIR & Title III tapes).
 - Enhance and copy all recorded audio information.
 - Prepare transcripts of all recorded audio (FLIR & Title III tapes).
 - ♦ Identify all instances of gunfire from listening devices, within the constraints of the recorded material.
 - Review, enhance and transcribe FBI video tape 1050236.
 - Identify all instances of gunfire from FBI video 1050236.
 - ◆ Enhance and transcribe other sections of the March 16, April 17 and April 18, 1993, Title III tapes as directed by the OSC.
- 1.3 To carry out these instructions, Network International has:
 - Examined all the audio information available on the April 19, 1993, FLIR and Title III tapes. 1
 - ◆ Analyzed sounds to determine if any gunfire can be specifically identified within the Title III recordings of April 19, 1993.
 - ◆ Carried out a detailed analysis in respect of originality of the April 19, 1993, FLIR and Title III tapes.
 - ♦ Enhanced and copied all available audio information to Compact Disc and cassette tape.
 - ◆ Produced type written transcripts of the information available on the enhanced copy material.
 - ♦ Enhanced and copied the sound track of FBI Video 1050236.
 - ◆ Carried out a detailed analysis of the sound information from FBI Video 1050236.
 - Produced a type written transcript of the information available on the enhanced copy material of the video soundtrack.
 - ♦ Enhanced and copied sections of 4 (four) Title III tapes from March 16, April 17 and April 18, 1993 to Compact Disc and cassette tape.

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¹ Cain says at page 4 of his report "Forensic tape protocols of the FBI, the AES, the ACFE and ABRE state <u>tape copies cannot be authenticated</u>". Cain says at page 3 of his report "Analogue and digital reproductions of the tapes were made with the <u>dubbed copies</u> being used for tape <u>enhancement/authenticity</u> purposes.

◆ Produced type written transcripts of the information available on the enhanced copy material of the 4 (four) sections requested by the OSC.

- 1.4 Network International has received the following tapes:
 - 1.4.1 SA-WDTX 73 Day 2 Tape 2 4/19/93 SA-WDTX - 73 Day 2 Tape 3 - 4/19/93 SA-WDTX - 73 Day 2 Tape 4 - 4/19/93 SA-WDTX - 73 Day 2 Tape 5 - 4/19/93 SA-WDTX - 72 Day 11 Tape 30 - 4/19/93 SA-WDTX - 72 Day 11 Tape 31 - 4/19/93 SA-WDTX - 72 Day 11 Tape 32 - 4/19/93
 - 1.4.2 FLIR tape labeled Q1
 FLIR tape labeled Q2
 FLIR tape labeled Q3
 FLIR tape labeled Q4
 FLIR tape labeled Q5
 FLIR tape labeled Q6
 FLIR tape labeled Q7
 - 1.4.3 FBI Video 1050236
 - 1.4.4 Copy tape of SA65 tape 24 dated the 16th of April 1993 Copy tape of SA72 tape 25 dated the 17th of April 1993 Copy tape of SA72 tape 28 dated the 18th of April 1993 Copy tape of SA72 tape 29 dated the 18th of April 1993
 - 1.4.5 24 (twenty-four) video test tapes in respect of all serviceable Panasonic VHS recorders from Nightstalker aircraft.
 - 1.4.6 3 (three) audio cassette tapes for voice ID labeled as

```
SCSL01-0700217 – Cat N° 16308
SCSL01-0700266 – Cat N° 16247
SCSL02-12000012- ALF shooting 2-28-93
```

5 (five)video cassette tapes for voice ID labeled as

- ♦ Clive Doyle/Graham Cruddock
- ♦ SCSL04-10900013-Branch Davidian members March 9,1993
- ♦ Reno's AVRAAM processing –02350-Thibodeau & others
- ♦ SCSL04-11000026-FBI 1110025
- ◆ SCSL01-09700014-Koresh family-1B274-March 8, 1993

- 1.5 Network International has received the following documentation:
 - ◆ Report documentation in respect of Steven Cain, Harry Hollien and Bruce Koenig.
 - ◆ Report documentation in respect of the Technical Services Division of the FBI, Washington.
 - ♦ FBI Transcripts of Title III tapes.
 - Paul Ginsberg Transcripts of Title III tapes.
 - ♦ Mark Swett transcript excerpts
 - ◆ Transcript of Video Deposition of Steven Cain.
 - ◆ Transcript of Paul Ginsberg testimony (5/3/00).
 - ◆ Copy of Operator's handbook for Panasonic Video recorder model AG-7400.
 - ♦ Final Report of Vector Data Systems (U.K.) Ltd.
 - Support documentation in respect of instructions from the OSC.

2. Copying Procedures

2.1 The 7 (seven) Title III cassette tapes have been enhanced and copied to the following:

```
SA-WDTX - 73 Day 2 Tape 2 - 4/19/93 - CD (2 discs) & Cassette CMM/9 SA-WDTX - 73 Day 2 Tape 3 - 4/19/93 - CD (2 discs) & Cassette CMM/10 SA-WDTX - 73 Day 2 Tape 4 - 4/19/93 - CD (2 discs) & Cassette CMM/11 SA-WDTX - 73 Day 2 Tape 5 - 4/19/93 - CD (2 discs) & Cassette CMM/12 SA-WDTX - 72 Day 11 Tape 30 - 4/19/93 - CD (2 discs) & Cassette CMM/13 SA-WDTX - 72 Day 11 Tape 31 - 4/19/93 - CD (2 discs) & Cassette CMM/14 SA-WDTX - 72 Day 11 Tape 32 - 4/19/93 - CD (1 disc) & Cassette CMM/15
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The 7 (seven) individual Title III sound tracks were copied to the computer system hard disc for analytical and enhancement purposes and listed within the hard disc as Sonic: SND: Recording: SA73-2.2, SA73-2.3, SA73-2.4, SA73-2.5, SA72-11.30, SA72-11.31 and SA72-11.32.

2.2 The 7 (seven) FLIR video tape audio sound tracks have been enhanced and copied to the following:

```
FLIR tape labeled Q1 - CD (2 discs) & 2 Cassette's CMM/1 & CMM/2 FLIR tape labeled Q2 - CD (2 discs) & 2 Cassettes CMM/3 & CMM/4 FLIR tape labeled Q3 - No audio copies made FLIR tape labeled Q4 - CD (2 discs) & 2 Cassettes CMM/5 & CMM/6 FLIR tape labeled Q5 - CD (2 discs) & 2 Cassettes CMM/7 & CMM/8 FLIR tape labeled Q6 - No audio copies made FLIR tape labeled Q7 - No audio copies made
```

The 7 (seven) individual FLIR video tape sound tracks were to the computer hard disk for analytical and enhancement purposes and listed as Sonic: SND: Recording: FLIR

Q1, Q2, Q3, Q4, Q5, Q6 and Q7.

The 7 (seven) FLIR video tapes were converted and copied to PAL version VHS tapes as a record of their visual and auditory content.

- 2.3 Video FBI 1050236 audio sound track has been enhanced and copied to CD (1 disc) & 1 Cassette CMM/16.
- 2.4 The four additional sections have been enhanced and copied to: SA65 tape 24 [side A only] 16 March, 1993, to CD & Cassette CMM/17. SA72 tape 25 [side B only] 17 April, 1993, to CD & Cassette CMM/18.

SA72 tape 28 - [side B only] 18 April, 1993, to CD & Cassette - CMM/19.

SA72 tape 29 - [side A only] 18 April, 1993, to CD & Cassette - CMM/20.

- 3. Equipment, Enhancement & Transcription
- 3.1 Equipment Network International has a total of three audio laboratories and two video laboratories in-house at its disposal.

Each audio laboratory contain a central sound control and enhancement system utilizing Sonic Solutions StudioTM ("Sonic Solutions") and NoNoiseTM system version 5.6. The system runs on a Macintosh 8500/180 platform with outboard Tyrestor 9-Gbytes external dedicated memory. The Audio system is stand alone and is not networked or utilized for any other purpose other than Audio enhancement and analysis.

Each laboratory uses Complex filtering, Declicking, DeKrackling and NoNoise suite software for the enhancement of audio data. Sonic solutions is connected to a series of outboard playback machines via an 8-channel Analogue to Digital converter and optical links. It has a full suite of digital signal processing that allows time domain and frequency domain analysis of audio information. All processes are dynamic and operator controlled.

Network International also utilizes a CSL speech Laboratory computer system running on an IBM 486 platform to conduct spectrographic analysis of audio information. The CSL captures a segment of audio [up to 16 seconds long] and displays it in both time domain and spectrographic form. The spectrographic analysis in conjunction with the time domain analysis provides detailed frequency and amplitude data in relation to the audio information captured and displayed. The CSL screen data can be printed via a high definition laser printer

3.2 Enhancement – The OSC considered that the material should be enhanced to improve the intelligibility of the speech and other sounds detected from within the Branch Davidian compound.

I employed Frequency Domain analysis of individual sound segments coupled with critical listening to both the Title III tapes and the FLIR video sound tracks. Start point parameters were set for each segment of sound based on the frequency analysis and detailed critical listening. Prior to enhancement extended periods of the Title III tapes were considered to be virtually unintelligible. The enhancement procedures were designed to specifically reduce the 'hum' content, lower the general background noise and increase the intelligibility of the speech content. The enhancement operated on interference surrounding and under the speech data, it did not adversely affect any of the voices within the recordings. The overall volume of the speech was adjusted for maximum intelligibility after enhancement processes had been applied. Each enhancement was performed dynamically with NoNoiseTM parameters and any filter settings being constantly monitored and adjusted as the circumstances changed to achieve what was perceived as the 'cleanest' output. The enhancement product was copied to good quality cassette utilizing Tascam 112R Mk2 cassette recorders and cut to Compact disc utilizing the Sonic Solutions CD production platform.

3.3 The Sonic system panels at Figure 1 and Figure 2, show the filter and NoNoiseTM 'start point' settings applied to the Title III and FLIR Video enhanced copy product.

Specifically the NoNoise $^{\text{TM}}$ parameters gave broadband background noise reduction to the information above 40Hz in the Title III tapes and above 220Hz in the FLIR Video tapes.

Noise reduction is carried out within the Sonic Solutions™ system, by sampling the background sound and producing a frequency profile of interference detected during analysis of the sound data. The profile is used as an 'estimate' of the amplitude and frequency range of the interference. The NoNoise system reduces the background interference in real time, under operator control, as the digitized material is played back from the computer.

Specific filters in the output of the system further enhanced the resulting sound data before copying.

In the case of the Title III tapes a 60Hz-centered digital narrow notch filter significantly reduced any 60Hz 'mains hum' interference.² High and Low Shelf filters set between 87.4Hz and 10920Hz restricted noise outside of the speech band.

² A single significant 60Hz mains hum with very low level harmonics [120, 180, 240 Hz] were found during analysis of the 'original' Title III tapes – not a series of high level harmonics as suggested by Cain, at page 5 of his report of February 24, 2000. Cain examined his own copies, not original tapes – copying can create a secondary harmonic structure of individual high level 60Hz related frequencies [120Hz, 180Hz etc.].

In the case of the FLIR Video tapes, after noise reduction, High and Low Shelf filters between 87.4Hz and 10920Hz restricted any noise outside the speech band.

The NoNoiseTM and filter settings were constantly monitored and adjusted during playback and copying for optimum intelligibility of the speech data.

Figure 1. The 'start' parameters for Title III enhancement.

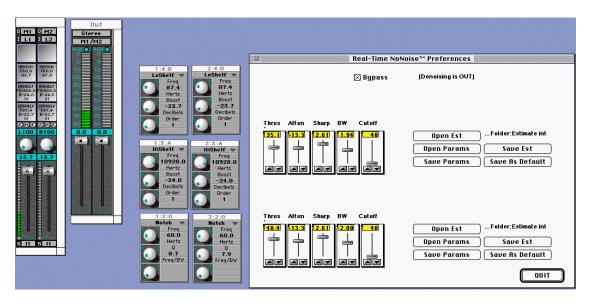
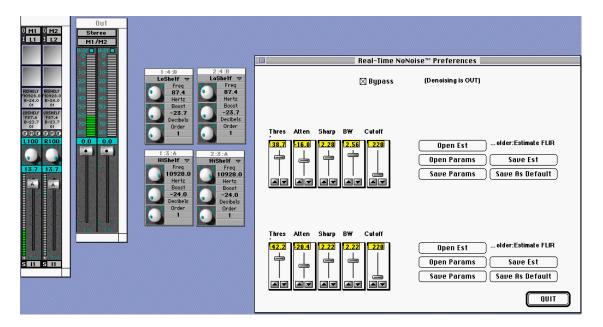


Figure 2. The start parameters for FLIR tape enhancement.



3.4 Transcription³ – The OSC have several different versions of transcripts of the information from the Title III tape transcripts prepared by Paul Ginsberg, the FBI and some excerpts prepared by Mark Swett. It was deemed essential to produce the most complete and accurate transcripts possible, so as to understand as fully as possible events inside the Branch Davidian complex on April 19, 1993. The OSC also wanted to know if specific instances of gunfire could be identified within the Title III recordings of April 19, 1993.

I used Sonic Solutions $^{\text{TM}}$ to transcribe and analyze the enhanced audio information from the Title III tapes.

First, I selected sound segments of varying length from the recorded sound files. These segments were then repeatedly listened to whilst compiling the individual transcripts. Enhanced sound files were reviewed a minimum of 10 to 12 times during the transcription process. The transcripts were typed directly into a word processing system. All subsequent amendments were also typed direct into a word processing system; this avoids handwritten notation being mistyped into a transcript.

I have had access to transcripts produced by the FBI, Paul Ginsberg and Mark Swett. I have considered and compared my transcripts with the other transcripts available. The final transcripts have been prepared with extreme care.

The Title III tapes of March 16, April 17, 18 and 19, 1993 have recorded speech, movement noise of the occupants, noises associated with activity within the complex as well as outside sounds, such as vehicle noise.

I have annotated the transcripts with descriptions of certain sounds, such as movement noise and vehicle noise. I could not identify specific sounds that 'could' be gunfire or firearms being readied within the complex.

Specific sounds need comparable known data to establish their identity. If I cannot recreate the known sound of a rifle being 'loaded' or 'readied' within the confines of the Branch Davidian complex, I cannot compare that sound data with recorded sounds on the Title III tapes and say whether they were the same or similar. I cannot create accurate 'test data' and therefore cannot give opinions as to whether any specific sounds recorded to the Title III tapes on March 16, April 17, 18 and 19, 1993 can be identified as gunfire.

Within the transcripts I have noted instances of loud and distinct sounds with the label [Unspecified sound], where certain identification has not been possible.

³ Ginsberg, FBI and Swett transcripts were reviewed and considered in preparation of my transcripts.

A final run through using the enhanced cassettes of the Title III tapes (CMM/9 to15) allowed cassette running times to be inserted at key points through the typed transcripts.

The OSC required an accurate account of the information available on the audio tracks of the FLIR Video tapes that covered April 19, 1993. The audio information needed to be correlated with the time and date information available within the FLIR Video tape images.

I used the same technique and equipment to produce the FLIR Video tape transcripts. The transcripts of the FLIR Video tapes were annotated with the onscreen times from the date and time visible within the image of 'original' video tapes Q1, Q3, Q4 & Q5.

The transcripts of the Title III and FLIR Video tapes reflect my very best efforts at deciphering and interpreting the information available over repeated critical listening. Annotation within the transcripts gives a description of any sounds that could or could not be identified.

The Title III transcripts are attached at appendix B

B-1 – 16 March, 1993.

B-2 17 April, 1993.

B-3 – 18 April, 1993.

B-4 – 19 April, 1993 - WDTX 72.

B-5 – 19 April, 1993 - WDTX 73.

The FLIR Video tape transcripts are attached at appendix B.

B-6 – Q1, 19 April. 1993, 05:58:17 to 08:00:02.

B-7 – Q2, 19 April, 1993, 07:57:51 to 09:28:18.

B-8 – Q4, 19 April, 1993, 10:42:06 to 12:16:13.

B-9 – Q5, 19 April, 1993, 12:16:44 to 13:39:07.

3.5 Speaker Identification - The OSC wanted to assess the possibility of Speaker identification using known reference material against the information and speech data within the Title III tapes.

The OSC instructed Mrs Elizabeth McClelland, a voice analyst, and associate of Network International, to examine the Title III tapes for the purpose of the assessing whether or not conclusions on Speaker Identity or Non-Identity could be formed. Mrs McClelland was provided with reference samples of speech of David Koresh, Stephen Schneider, Wayne Martin, David Thibedeau, Clive Doyle, James Castillo and Graeme Cruddock for comparison with the voices heard in the Title III tapes.

Mrs McClelland found that the sound quality in the Title III tapes was too poor for conclusions on speaker identity to be reached at any level of certainty. The amplitude of the recorded voices was at times low and the clarity necessary for voice ID frequently obscured by high levels of background noise and other interference.

Although on an auditory-phonetic basis, some features of the questioned voices were found to match the reference speech samples of the individuals listed, the technical standard of the recordings meant that instrumental analysis of the speech signal produced no meaningful results.

Clause 5 of the Code of Practice of the <u>International Association for Forensic Phonetics</u> states that:

"Members should make clear their level of certainty in expressing a conclusion, and give an indication of where their conclusion lies in relation to the range of judgements they are prepared to give"

Mrs McClelland concluded that the recording of the speech data in the Title III tapes of April 19, 1993 were not at a standard where Forensic Speaker Identification conclusions could be reached at a level of certainty which could be stated on a scale of opinion.

The OSC chose not to attempt Forensic Speaker ID, in light of the uncertainty.

4. <u>Title III tapes</u>

4.1 The Title III tapes represent the record of events within the Branch Davidian complex during March and April, 1993. The OSC wanted to determine the originality and authenticity of the Title III tapes in respect of April 19, 1993. Other experts⁴ have made various statements in relation to the veracity of the tapes. It was my task to carry out an analysis of the Title III tapes recorded on April 19, 1993 and determine if there was any scientific evidence to say that they had been interfered with in any way or that they were not original recordings.

Overview of Title III tape recording methodology.

During the FBI's operation at the Branch Davidian complex Title III intercepts, transmitting devices, were covertly introduced into the building.

The Title III intercepts relayed information to receivers a short distance away. The Title III intercepts were battery powered and had limited operational life spans.

⁴ Only Steve Cain of ATFI Intl, Inc. has produced a full report in respect of the authenticity of the Title III & FLIR Video tapes.

The transmitted information was arbitrary, in that the location of devices, once inside the complex was beyond the control of those outside. Wherever the devices ended up, information from the proximity of the device would constitute the relayed information.

FBI monitors reviewed the transmitted information at a receiving station and passed relevant audio data via telephone lines to a recording station. The monitoring and recording were performed under Title III monitoring protocols. The quality of the monitored and recorded audio data was poor. The speech data was infected with high levels of background noise, hum and other interference such as vehicle noise.

I understand from information provided to me by the OSC, at least 2 (two) telephone lines were available between the monitoring and recording stations. The recording stations consisted of at least 10 (ten) Marantz PMD-221 cassette recorders and 3 (three) Tascam 112 cassette recorders. The receivers and recorders in the 'sound chain' were under manual control by those monitoring and recording.

Three cassette recorders simultaneously recorded individually monitored signals. Red, Yellow and White label correlated cassette tapes were produced from each individual signal input creating three sets of the same audio data. The machines would generally continuously record, however the signal input might have been changed from one channel to another during the recorded period by those controlling the signal source.

On April 19th 1993, the FBI had two Title III intercepts inside the Branch Davidian complex, WDTX 72 and WDTX 73.

The information from intercepts WDTX 72 and WDTX 73 were relayed and recorded to a Red, Yellow and White set of tapes. The Red set are listed and labeled as:

```
WDTX 73 - Day 2-Tape 2-4/19/93 (Time ON 00.00 - Time OFF 07.18) WDTX 73 - Day 2-Tape 3-4/19/93 (Time ON 07.18 - Time OFF 08.52) WDTX 73 - Day 2-Tape 4-4/19/93 (Time ON 08.52 - Time OFF 10.30) WDTX 73 - Day 2-Tape 3-5/19/93 (Time ON 10.30 - Time OFF 13.00) WDTX 72 -Day 11-Tape 30-4/19/93(Time ON 12.10 - Time OFF 07.08) WDTX 73 -Day 11-Tape 31-4/19/93(Time ON 07.09 - Time OFF 12.21) WDTX 73 -Day 11-Tape 32-4/19/93(Time ON 12.22 - Time OFF 13.18)
```

The change over times from tape to tape were manually recorded and only indicate whole hours and minutes. The time difference between for instance the end of tape 30 at 07.08 and the onset of tape 31 at 07.09 may have been a matter of seconds, i.e. the time it took to change the tape.

It is these 'Red' label tapes that are the subject of this examination in respect of:

- ♦ Their originality
- ♦ Their authenticity
- ♦ Their content
- Their recording of specific incidents and sounds

4.2 Analysis of Title III tapes

I have subjected each Title III tape to a detailed auditory, physical and computerized examination. They have all been recorded in a stereo recording machine. The audio input is mono-aural, that is, a single audio source creates both stereo tracks within the recording system. Mono-aural audio input is a function that is available on the Marantz PMD 221 recorder, a single source of sound connected to a single channel will record simultaneously to both the left and right channel of a stereo track. They have been recorded at a standard speed of 4.8 centimetres per second.

All 7 (seven) tapes are standard C90 audio cassette tapes recorded at a standard speed of 4.8cm/second. In practical terms, given that the recording machines were running at or near 4.8cm/second, a maximum recording time of somewhere between 47 minutes and 49 minutes would be available on each side of each tape.

Red set WDTX 73 - Day 2, tape 2, 3, 4 & 5 are recorded IN and OUT of machinery at the given times as listed in 4.1 above.

Red set WDTX 72 - Day 11, tape 30, 31 & 32 are recorded IN and OUT of machinery at the given times as listed in 4.1 above.

If the times noted were actual record times, the tape for WDTX 73 would have covered from Midnight (00.00) to 13.00, a period of 13 hours. The tapes for WDTX72 would have covered from 10 after midnight to 13.18, a period of 13 hours and 8 minutes. The two sets of tapes cannot have physically recorded around 13 hours of tape each. There is approximately 6 hours and 10 minutes of tape available on four (4) C90 tapes if both sides are used as in the WDTX73 series. There is approximately 4 hours 40 minutes available on three (3) C90 tapes if both sides are used as in the WDTX72 series.

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⁵ Cain says at page 4 of his report of February 24, 2000, that "there was frequency and magnetic development related data which indicated that most tapes were probably recorded with stereo heads and that the audible conversations went from leader to leader with few recorded stops".

The 'Time IN' and 'Time OUT' times marked on both sets of Red set tapes cannot constitute practical recording times. ⁶ The times marked on the tapes must be the actual time of insertion into recording machines and not necessarily the 'start to record' times.

Utilizing correlated references within transcripts and the IN/OUT times where appropriate I can say the following 'time line', figure 3, represents an overview of the 'real' recording times. It is not claimed that the time lines are absolutely accurate. They provide a reasoned approximation of the times, calculated from tape run times and other information. It however fits extremely well with known event times at the Branch Davidian complex.

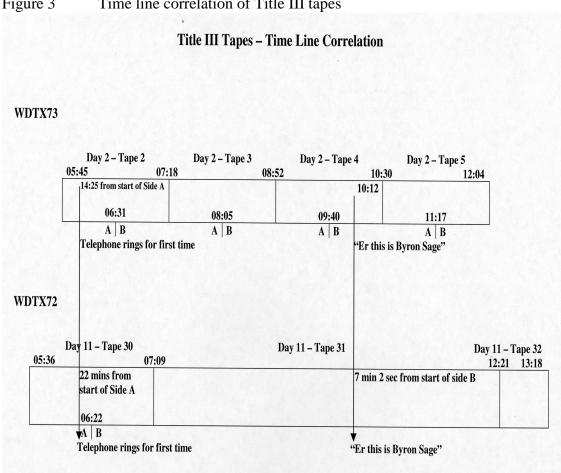


Figure 3 Time line correlation of Title III tapes

⁶ Cain says "The listed time frames on FBI labels for turning on and off the recorders were confusing especially since some of these times involved more than a six hour period which is impossible to occur on a ninety minute cassette tape which is supposedly recorded continuously".

4.3 Originality of April 19, 1993 Title III tapes

Using the time line graphic as a guide, ⁷ I can demonstrate that the WDTX73 set of recordings correlate to a near-continuous monitoring and recording operation during the period of approximately 05.45 to approximately 12.04 on the 19th of April 1993.

14 minutes and 25 seconds from the start of Day 2 - Tape 2, a telephone is heard to ring and a conversation takes place within the confines of the Branch Davidian complex. The same telephone ringing and conversation can also be heard at 22 minutes in from the start of Side A of Day 11 - Tape 30.

Day 2 – Tape 2 is a continuous recording throughout its side A and B. The tape is extracted from the machine at approximately 07.18 and marked accordingly. Working backwards, the tape would have been turned over from side A to side B at approximately 06.31. Side A is recorded without any breaks. The telephone rings at 14 minutes and 25 seconds from the start of side A of Day 2 - Tape 2. Working backwards again, this tape must have started recording at approximately 05.45. I can say that the telephone call took place at approximately 05.58 on April 19, 1993.

Day 11 – Tape 30 is continuous throughout side A and B. The tape was extracted from the machine at approximately 07.09 and marked accordingly. As the telephone call was made at approximately 05.58, Day 11 – Tape 30 must have started recording at approximately 05.36.

I can say that the times marked as 'Time IN' on both these tape are not related to the actual onset of recording, but are most likely the times the tapes were initially inserted into the machines, in readiness to record.

The tape sequence from WDTX 72 has initially recorded a similar source input to the tape sequence from the WDTX 73 series of tapes up until 31.20 on Day 11 - Tape 30. At this point the information/sound source changes. The tape is not stopped or restarted but the source of the audio changes. It is no longer speech data from inside the complex mixed with broadcast material by Byron Sage. The audio data recorded to the remaining tapes in the WDTX 72 series, records broadcast information only, by Byron Sage. As Byron Sage continues to broadcast, the machine recording his broadcast is switched into and out of record at various points.

⁷ Cain says at page 8, "the developed spectrographic/waveforms provided additional evidence of Q4 [our reference WDTX 73 Day 2- Tape 2] and Q5 [our reference WDTX 72 Day 11 –Tape 30] being tape copies and not original recordings as the same material cannot appear on two different tapes at apparently two different times unless they are 'duplicate original' recordings". [see this report figure 3].

From 31.20, Day 11 – Tape 30 onwards,⁸ the sequence of Byron Sage broadcasts do not constitute a continuous recording. It is probable that from the change point at 31.20, the Byron Sage broadcasts were a direct input to the recording machines that were recording the WDTX 72 series of tapes. The WDTX 72 sequence of tapes, after the change point, contains reasonably clear speech with minimal levels of background interference.

Apart from the obvious turning over from side A to side B, the four (4) WDTX 73 tapes represent a continuous recorded sequence of events between approximately 05.45 and approximately 12.04 on the 19th of April 1993.

The WDTX 72 series of three (3) tapes are recorded over an extended period between 05:36 and 13:18 on April 19, 1993. The extended recording period (covering a longer period of time than the tapes could record for) is a result of WDTX 72 Day 11 – Tape 31 being paused or stopped and restarted at various times.

WDTX 72 Day 11- tape 30 has a 'change of sound source' during it's side A but the recording is not paused or stopped.

The 'change of sound source' occurs at:

Side A @ 32.54 – switched to Byron Sage broadcasts only.

WDTX 72 Day 11 - tape 31 has been subjected to a series of stop-starts either by a PAUSE action or an Off/On action by the recording machine at the following times:

Side A @ 44.20 - PAUSE action - Sage .. I've contacted the commanders

Side B @ 07.05 - PAUSE action - Good morning .. this is er Byron Sage

Side B @ 13.00 - PAUSE action - We are continuing to place tear gas

Side B @ 16.03 - PAUSE action -We're still here and so are you

Side B @ 20.55 - PAUSE action - David .. its Byron Sage again

Side B @ 26.27 - Off/On - David its er time for this to be over

Side B @ 31.55 - Off/On - See we're trying to facilitate your leaving

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⁸ Cain says: "Note: The bulk of the recorded conversation on Q6 sides A and B [Our ref: WDTX 72 Day 11 – Tape 31] involve FBI surrender announcement with no Branch Davidian conversations. This appears to be a composite tape involving FBI only conversations occurring between 07.09 a.m. and 12.21 p.m. ... and is highly suspicious and has no integrity/trustworthiness".

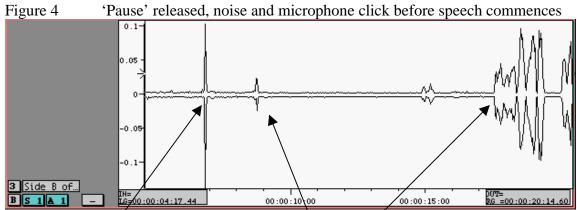
Side B @ 36.38 - PAUSE action - Stop .. raise your hands

Side B @ 38.35 - PAUSE action - Er don't do this to your people

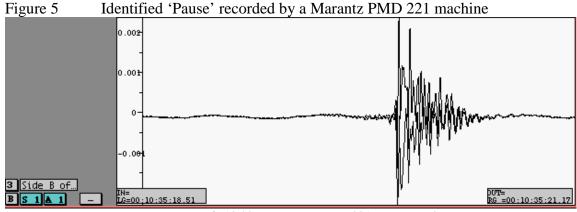
I have identified the various machine actions within the WDTX 72 recordings as either a 'PAUSE' action or an 'Off/On' action. These identifiable machine actions now provide a template of what those particular functions on a Marantz PMD 221 type of machine will look like when recorded to tape.

I have compared any suspicious points within the Title III tapes with known Marantz recorder actions. In terms of authenticity it provides evidence to say whether any such actions occur elsewhere on the Title III tapes that would suggest that manipulation of the recordings has occurred.

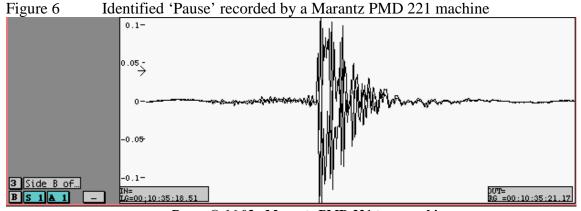
Figures 4 to 9 show comparisons between 'Pause' actions and 'Off/On' actions within the Title III tapes. They demonstrate the ability to identify not only that machine actions have occurred but that different machine actions are detectable and identifiable.



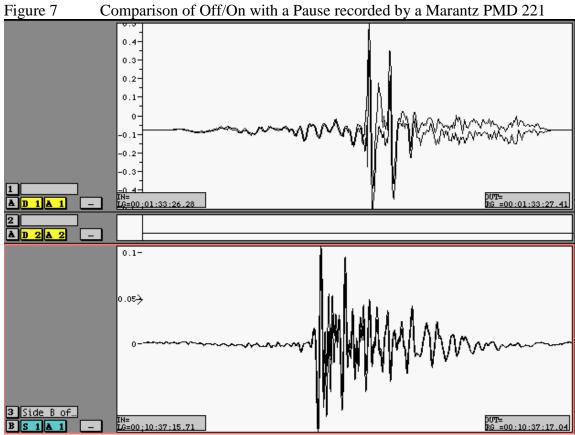
Pause action @ 07.05 - microphone click - 'Good morning .. this is Byron Sage



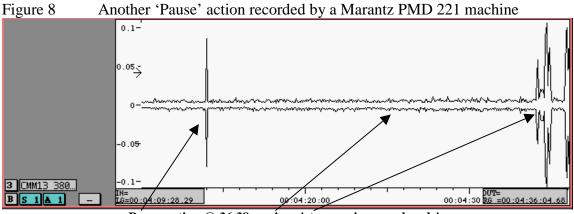
Pause @ 13.00 - Marantz PMD 221 type machine



Pause @ 16.03 - Marantz PMD 221 type machine



Off/On (top) @ 26.27 -v- Pause (bottom) from 20.55 - Marantz PMD 221 type machine



Pause action @ 36.38 - noise - 'stop .. raise your hands' Marantz PMD 221 type machine

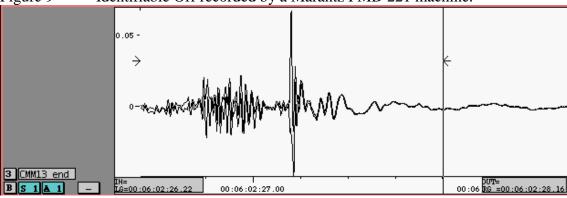


Figure 9 Identifiable Off recorded by a Marantz PMD 221 machine.

Off action at the end of Side B 72 Day 11 Tape 30

From my analysis of the Title III tapes of April 19, 1993, I can say:

- ♦ I can find no evidence that WDTX 73 Day 2 tapes 2, 3, 4 & 5 have been stopped, restarted, paused or otherwise interfered with during their recording sequence.
- ♦ I can find no evidence that the WDTX 73 Day 2 tapes 2, 3, 4 & 5 have been subjected to any copying process.
- ♦ WDTX 72 Day 11- tape 30 has not been stopped, restarted, paused or otherwise interfered with during its recording sequence. It is an original recording.
- ♦ WDTX 72 Day 11- tape 32 has not been stopped, restarted, paused or otherwise interfered with during its recording sequence. It is an original recording.
- ♦ WDTX 72 Day 11 tape 31 has been stopped, started and paused during its recording sequence. It is an original recording.
- ♦ I can find no evidence that the WDTX 72 Day 11 tapes 30, 31 & 32 have been subjected to any copying process.

4.4 Physical Analysis of Title III tapes

The PAUSE and Off/On actions on WDTX 72 Day 11 tape 31 are clearly detectable aurally and by computer analysis. They can be both seen and heard. It has been possible to compare the individual PAUSE actions and say that there is a high degree of correlation between them. The correlation is such that they would have been produced by a similar, if not the same, machine.

The Off/On actions also display a high degree of correlation between themselves and other Off actions at the end of some recordings.

I have produced photographic records of the track striations and configurations on both sets of tapes. (See Appendix A).

I have photographed the beginning, middle and end of each tape in the sequence. I have physically examined, microscopically, the entire tape within each Title III cassette relating to April 19, 1993.

The physical evidence shows that the recorders tend to vary the height position of the recorded tracks as the tape progresses through the machine. (See Appendix A, figures A1, A2, A3 and A4). It also shows that the side B recordings (the top track in the photographs) consistently fall off the edge of the tape. Both these phenomenon are present in some degree or other throughout both sets of recordings. It is therefore highly likely that both sets of tapes were made in a similar make and model of recording machine.

There is however a physical difference in tape track configuration between the recordings of the WDTX73 and the WDTX72 set of tapes. (See Appendix A, figures A1 and A5). The extent of the difference is the physical gap between the left and right stereo channels. Additionally the physical track positioning within the tape is different.

I conclude that the two sets of tapes were recorded in different machines.

From the physical analysis and measurement of the track configurations I conclude that WDTX73, Day 2 tapes 2, 3, 4 & 5 were recorded on the same machine. (See Appendix A, figures A1, A2, A3 and A4).

The physical measurement of the photographs of the WDTX72 tape set, (Appendix A, figures A5 to A7), confirm that Day 11-Tape 32 was recorded in a different machine than the other two tapes in the set. I conclude, therefore, that Day 11-Tape 30 and 31 were recorded within the same machine. I find no indication that WDTX 72 Day 11-Tape 32 was copied. Rather it was created in another Marantz PMD 221 type machine. (See Appendix A, figure A7).

4.5 Authenticity and originality of Title III tapes of April 19, 1993

The OSC require evidence that the Title III tapes marked as being recorded on April 19, 1993, are authentic. That is to say that they are the genuine and can be proved to be the tapes recorded on that day and at that time.

Authenticity relies on being able to say that the tapes examined are not copies and that their history shows them to be genuine.

⁹ Cain says, "Side A track configuration different from Side B. (Possibly two different recorders).

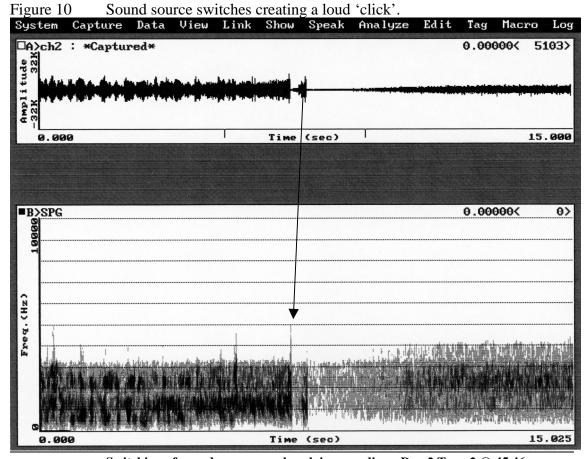
Having now identified the machine actions that would be used to stop or pause the machinery during any recordings, I have compared the auditory and computerized signatures with any clicks, bumps or contentious sounds with in the Title III tapes.

There is a high level amount of 60Hz hum, movement noise, microphone contact noise and other unidentifiable sounds on the April 19, 1993 Title III tapes. Each tape is recorded against a background of Byron Sage broadcasting nearly continuously. Also in the background, high levels of ambient noise and other interfering sounds have been recorded. It therefore is difficult to isolate and determine the source and composition of many of the sounds recorded. Where identification of a particular sound is not deemed possible, I have labeled it as [Unspecified]. Unspecified sounds were detected both auditorily and spectrographically, but no certain determination of their origin can be made.

There are points within the Title III recordings where abrupt sound level changes occur. There are other points where loud sounds cause the recording to decrease and then recover its volume. I have annotated these changes in the Title III transcripts. I have also compared the points at which sound levels change on the Title III recordings with the known PAUSE and Off/On actions.

Most of the abrupt sound level changes are the result of a change of sound data source, most likely at the monitoring station. The recording devices are not stopped but the monitoring station is switching between sound data sources. FBI monitors listening to the signals for onward transmission, are switching through various receiver channels or control equipment [probably checking if the sound sources are active or not]. Each of these changes in sound levels is preceded by a sharp click sound. I can say that these abrupt changes do not result from a recording machine action such as STOP, PAUSE or RECORD.

I have produced spectrographic charts [Figures 10 and 11] as a sample of the areas of the recordings where abrupt changes in sound levels occur. To the left of the upper time line chart is the sound data being listened to. The arrow indicates where the switch of sound data occurs. There is no break in the recording or any indication of a machine action such as 'Pause' or 'Off/On'.



Switching of sound source - no break in recording - Day 2 Tape 2 @ 45.46

When the Title III intercepts record sharp or loud sounds, the sound falls and then recovers. This 'fall and recovery' is caused by the machines Automatic Gain Control ('AGC') which is built the Marantz PMD 221.

Whenever a loud sound is received by the recording machine that exceeds its maximum recording level, the AGC prevents the signal from overloading and distorting the recording to tape. The effect of the AGC is to very quickly reduce the recording level and then slowly return it to normal. This effect of the AGC following a sharp sound can be shown spectrographically.

Figure 11 shows a loud click (indicated by the first arrow), followed by the sound reducing and starting to recover at the second arrow. The click is not an 'Off/On' or any other machine action, but an abrupt change in received sound from the Title III intercepts.

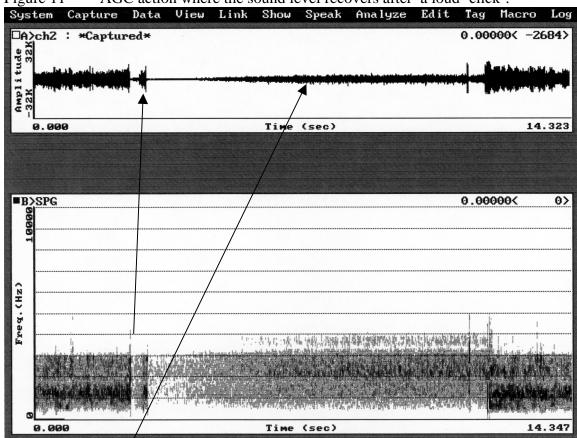


Figure 11 AGC action where the sound level recovers after a loud 'click'.

AGC Reaction after loud click - Day 2 Tape 2 after 45.46

4.6.1 Conclusions & Opinion

Having examined the Title III tapes of April 19, 1993, my overall conclusion is that there is no direct evidence of malicious alteration, editing or alteration.

The tapes have recorded speech data from inside the Branch Davidian complex that is in places, difficult to interpret.

The tapes have recorded an extraordinary amount of background information as well as the speech data.

My direct conclusions are

♦ The series of 'RED' label tapes WDTX 73 Tapes 2, 3, 4 and 5 represent a near continuous taped record of events at the Branch Davidian complex between approximately 05.45 and 12.04 on the 19th of April 1993. Only the sound data available during the short periods of time it took to physically change or turn over the tapes has not been recorded.

♦ The series of 'RED' label tapes WDTX 73 Tapes 2, 3, 4 and 5 show no electronic or auditory signs of having been stopped, started or otherwise interfered with during their individual recording periods.

- ◆ The series of 'RED' label tapes WDTX 73 Tapes 2, 3, 4 and 5 are original and authentic recordings produced in the same Marantz PMD 221 type machine.
- ♦ Given the recording circumstances within the Branch Davidian complex, the transcripts at Appendix B4, represent my very best efforts at interpretation and deciphering of the information produced by the WDTX 73 Title III intercepts, over the period of approximately 05.45 to 12.04 on the 19th of April 1993.
- ♦ The series of Red label tapes WDTX 72, tape 30, 31 & 32 constitute a partial recording of events between approximately 05.36 and 13.18 on the 19th of April 1993.
- ♦ WDTX 72 tape 31 has been paused, stopped and started at various times during its recording period.
- ♦ Red label tapes WDTX 72, tape 30, 31 and 32 have recorded a mixture of intercept material and prepared announcements by FBI negotiator Byron Sage.
- ♦ WDTX 72, tapes 30 and 31 were made in the same Marantz PMD 221 recording machine.
- ♦ WDTX 72, tape 32 was recorded in a different machine from the one that produced WDTX 72, tapes 30 and 31.
- ◆ The series of Red label tapes WDTX 72, tapes 30, 31 and 32 are original and authentic recordings.
- ♦ Given the recording circumstances within the Branch Davidian complex, the transcripts at Appendix B5, represent my very best efforts at interpretation and deciphering of the information produced by the WDTX 72 Title III intercepts, over the period of approximately 05.36 to 13.18 on the 19th of April 1993.

5. FLIR tapes

The OSC wanted to know if the FLIR video tapes were original and if they had been deliberately interfered with in any way. I have examined the FLIR Video Tape audio tracks with the visual data available.

5.1 Overview of (FLIR) Forward Looking Infrared tapes.

In conjunction with the on-the-ground operation at the Branch Davidian complex, on the 19th of April, 1993, an aircraft was circling the complex.

The aircraft, designated Nightstalker, had on board two video recorders whereby it could record any visual information from its Infra red camera system. The visual information consisted of the output from the video camera mixed with camera control [elevation and azimuth readings] time and date information. This visual information was recorded as an amalgamated video picture simultaneously by two Panasonic AG-7400 series S-VHS/VHS (NTSC) machines. The video recorders also recorded various channels of audio information.

Nightstalker flew from before 05.58 until after 09.28 when it returned to base for refueling. After refueling it resumed surveillance from 10.42 until after 14.02.

The ability to record simultaneous video and audio to both Panasonic machines within the aircraft was part of the technical set-up of the recording system. The video recorders would normally remain 'On' throughout the recording length of the video tapes, in this case E120 (2 hour) tapes. The operators changed tapes at slightly different (staggered) times, so that complete coverage of all events would be achieved.

Both the linear and HD audio channels were simultaneously recording any audio fed to the machines. Both machines recorded the same audio information, albeit with slightly different beginning and end times. The Nightstalker aircraft operator has the ability to 'turn off' the audio, not by any function of the video machines but by a controller operated 'mute' switch, remote from the video recorders. The audio is therefore monitored and controlled before being routed to the video machines. In this way, audio can be selectively recorded, whereas video can be interrupted only by manual operation of the individual video recorder controls.

Tapes produced by the Nightstalker FLIR on April 19, 1993, are the subjects of this examination in respect of:

- ♦ Their originality
- ♦ Their authenticity
- ♦ Their content

5.2 Analysis of FLIR tapes

I have conducted a detailed auditory, physical and computerized examination of the recorded audio tracks of FLIR tape Q1, Q2, Q3, Q4, and Q5. I have excluded FLIR Q6 and Q7 from the physical and computerized examination on the basis that they are identifiable copy recordings. I rely on Q6 and Q7 only to provide corroborative evidence of recorded date/times, video images and speech data.

The Panasonic AG-7400 Video recorder(s) installed in Nightstalker on the 19th of April 1993, were capable of recording in S-VHS (super VHS) as well as standard VHS format. In 1993, S-VHS type tapes were not readily available. This model of recorder was self-selecting, in that if a standard VHS tape was inserted it would select VHS recording mode. The FLIR recordings Q1 to Q5 are all standard E120 VHS tapes.

The Panasonic AG-7400 recorders had the ability to record 4 (four) channels of audio information as they recorded the video signal. Two channels can be recorded as linear analogue information, [along the edge of the video tape]. The other two channels, referred to as HD audio, are recorded as a hi-fi two channel audio signal by audio recording heads mounted on the video recording drum. The video and HD audio is 'mixed' at the recording stage in what is called 'Depth Modulation' mode. This is a common way of recording hi-fi audio within VHS video systems.

The audio data available within the aircraft communications system were relayed to the video machines and recorded as 'run along' audio tracks in parallel to the video information. The recorded audio consisted of a combination of communications information, air traffic control, ground radio channels, aircraft to aircraft and the occupants of the Nightstalker being recorded as they spoke to each other.

Multiple audio and video events are recorded that can be related to events elsewhere. This includes air traffic information, movement on the ground and radio communication events.

It is necessary to include the video images as part of the audio recording examination because they are inextricably linked. Others are also examining the video images for originality and content.

The video tapes also include recorded time and date information that can be related to events and occurrences during April 19, 1993. Using the time and date information available, it is possible to determine the sequence in which the tapes have been recorded. The timing on the video tapes confirms which tape was recorded in each of the two video recorders within the Nightstalker aircraft.

An inspection of the recorded times available from the time & date generation on each video tape indicates that originally 2 parallel sets of video tapes were being recorded within the Nightstalker aircraft.

It would take approximately 30 to 45 seconds to eject one video tape and replace it with another. An example of this sequencing is evident from Q4 to Q5 where Q4 is terminated at 12:16:13 and Q5 starts at 12:16:44. Another example would be Q3 terminating at 07:56:56 and Q2 starting at 07:57:51.

The time chart, figure 12, indicates the recorded sequence from the two machines available within the Nightstalker aircraft. It also indicates which FLIR video tapes are not available for this examination.

Figure 12 <u>Time Line Analysis of FLIR tapes</u>

Machine 1	Machine 2	
FLIR Tape Q1 - VHS E120 Tape	FLIR Tape Q3 - E120 VHS Tape	
On @ 05:58:17 Off @ 08:00:02 Picture breaks and continues with previous recording showing 05:11:22 Off @ 05:12:30	On @ 05:59:33 Off @ 07:56:56	
Original tape not available	FLIR Tape Q2 – E120 VHS Tape On @ 07:57:51 Off @ 09:28:18 Aircraft lands to refuel	
FLIR Tape Q4 – E120 VHS Tape Aircraft returns from refueling On @ 10:42:06 Off @ 10:47:16 [Break of 4minutes and 41 seconds] On @ 10:51:57 Off @ 12:16:13 [No speech or data recorded]	Original tape not available	Copy tape Q7 On @ 10:41:57 Off @ 12:41:07
FLIR Tape Q5 – E120 VHS Tape On @ 12:16:44 Off @ 13:39:07 [No speech or data recorded until 12:26:06]	Original tape not available	Copy Tape Q6 On @ 12:41:25 Off @ 14:01:35

From my initial examination of the FLIR Video tape audio and video information, I can say that:

- ♦ FLIR Video tape Q1 has been recorded on at least twice the last 'original' recording runs between 05:58:17 and 08:00:02. 10
- ◆ FLIR Video tape Q2 has recorded continuously between 07:57:51 and 09:28:18, when Nightstalker lands for refueling.
- ◆ FLIR Video tape Q3 parallels FLIR Q1 in that it is continuously recorded between 05:59:33 and 07:56:56.
- ◆ FLIR Video tape Q4 has been recorded in two sections separated by the video recorder being stopped/paused. Section 1 runs from 10:42:06 (after refueling) to 10:47:16. The second section runs from 10:51:57 to 12:16:13.
- FLIR Video tape Q4 has not recorded any meaningful audio.
- ◆ FLIR Video tape Q5 has recorded continuously between 12:16:44 and 13:39:07.
- ♦ FLIR Video tape Q5 has recorded meaningful audio from 12:26:06 onwards.

The time date generation within the video tapes recorded during April 19, 1993 can be related to visual and auditory events at the Branch Davidian complex and other corroborative information (air traffic control etc.). The video tapes created by the FBI Nightstalker on April 19, 1993 have not been manipulated or altered in any way after their production.

In this type of Panasonic machine if only one source of audio is connected to the audio inputs, the recorder automatically sends the audio to both the left and right hand linear channels. The HD [High Definition] audio channels would also record any single audio input into a stereo [two-channel] format.

The HD audio recording in a Panasonic AG-7400 model machine is created by two audio recording heads set into the same rotating drum of the video heads. As the video drum head spins, it 'lays down' the audio information as one set of frequencies with the video information laid down over the top as another.

In this way, high quality audio and video can be recorded onto the same tape. The frequency difference between the audio and video signals allows the audio information to be recorded at a deeper level into the video tape, than the video signal. The video information is of a higher frequency and records more towards

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¹⁰ Cain says "this over recording that lasts from 5:57 a.m. to 08:02 a.m. has literally erased the original audio and video content".

the surface of the tape. The difference in the recording depth creates 'Depth Modulated' recordings. Because the HD audio and video images are 'laid down' in this way, copy videos would have to be created to edit or alter the original video or audio information. If the video images are original then the HD audio created at the same time will be original.

FLIR Q1, Q2, Q3, Q4 and Q5 have original video images and HD audio recorded to them, any events that occur on the FLIR Tape audio channels that have original video associated with them and have been recorded during the original video time frame.

The FLIR tapes have recorded additional information to the video image such as time and date as well as the camera control information. These appear as small white letters and numerals within the image.

When copying VHS to other formats [as you would need to do to edit and recreate the video in any form] and then back to VHS, it becomes difficult to sustain the definition of the original video image. The numerals and letters that form part of the original video would become blurred and undefined. FLIR copy videos Q6 & Q7 demonstrate very well the effect of any such copying.

Video images in VHS systems are created by recording 2 (two) interlaced fields to produce a frame. The frames are then played at 30 frames a second in NTSC format to create the moving image. The electronic action of interlacing the 2 (two) fields takes place outside of the normal viewed video image [below the bottom of the picture]. The interlacing of the two fields is created by electronically switching from the one field to the other. The interlacing action creates a switching point that can be viewed by a video monitor that allows under scanning of the image area. The video monitor physically displays the electronic switching points (and other electronic signals) outside of the normal viewed video image area. Subsequent copying of VHS to VHS videos creates additional switching points. Although specialist equipment exists that can remove the additional switching points such as TBC's (Time base Correctors), they themselves affect the video image in other detectable ways. They sometimes remove lines of video or alter the frequencies that make up the video signal in some way.

FLIR Q1, Q2, Q3, Q4 and Q5 display a single switching point, and contain no evidence of any switching point having been removed. Moreover FLIR Q1 – Q5 do not contain evidence of the use of a TBC or other similar devices.

FLIR Q1 has recorded audio in HD and linear mode. Between the video recorded times of 05:58:17 and 08:00:02 I can find no evidence that the audio information stops starts or is otherwise interfered with in any way. Both the Linear and HD audio signals are present throughout the recording.

FLIR Q1 video tape had been previously recorded on before this 'original' recording was made. The video and sound that appear after the 08:00:02 are the remnants of a previous recording. There is an erasure sequence between the end of the material at 08:00:02 and the appearance of the previous material at 05:11:22.

Any tape put into a video recorder fully rewound will be passed across a full width erase head before being recorded, or in the case of FLIR Q1 re-recorded upon. The disruption to the video information between the end of the 08:00:02 sequence and the appearance of the 05:11:22 section is the effect of that section of tape passing the erase head. It is not a stop and restart sequence between the sections; it is a stop - erased tape - remainder of previous video - sequence. The erased portion equates to the physical length the video tape has traveled between the erase head and the video recording drum within a Panasonic AG-7400 video recorder.

Quite simply, the tape had been used previously, had been terminated at 05:12:30, rewound and reused to record the events between 05:58:17 and 08:00:02. Because the second recording was not as long as the first, the 'difference' material is still available on FLIR Q1 video tape.

FLIR Tape Q3 provides corroborative evidence of the sequence of events recorded over approximately the same time span as FLIR Q1. The audio recording stops, starts and is not interfered with in any way. Both the Linear and HD audio signals are present throughout the recording.

FLIR Tape Q2 follows FLIR Q3 in the sequence of events. The time and date generation is continuous between 07:57:51 and 09:28:18. The tape has recorded both the Linear and HD sound tracks. The audio recording is not interfered with in any way.

FLIR tape Q4 has recorded video information, including time, date and camera information in two sections. The first section is from 10:42:06 [the on-set of recording] until 10:47:16. The second section is recorded between 10:51:57 to 12:16:13 where the recording is terminated.

Panasonic AG-7400 video recorders were originally designed as portable recorders for the broadcast industry. They incorporate a 'fifth' head in the video recording drum that is called the 'flying video head'. The fifth head allows the Panasonic AG-7400 to perform 'back space edits' after pauses or arbitrary stops in recording.

If the Panasonic AG-7400 machine is 'Paused' or 'Stopped' during a record sequence, the video drum and its flying head perform a 'back space edit'. If the 'Pause' is released in less than 5 seconds, the machine just carries on recording

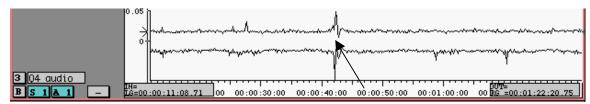
without the backspace. Because of the 'flying head' technology, any 'backspace edit' will be reasonably clean.

If the video scene or in this case the time and date information, did not change, an edit may be hard to detect. It may also be difficult to detect within the HD audio tracks. However the linear track(s) still perform a 'stop and restart' at 10:47:16 before recommencing at 10:51:57.

FLIR Q4 has not recorded any useful or viable information similar to the other FLIR tapes. The audio tracks have been interrupted at the same point as the video stops and restarts [10:47:16 & 10:51:57].

Figure 13 shows the disruption on the linear sound tracks at the point FLIR Video Tape Q4 was stopped.

Figure 13 Disruption of Linear track(s) during FLIR Tape Q4



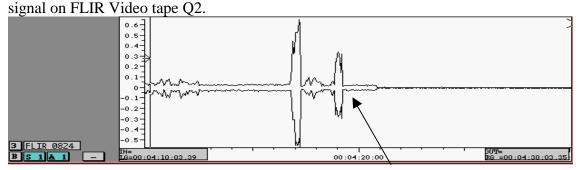
First 10 minutes of FLIR Q4 – [Paused/Stopped @ 10:47:16]

The FLIR tape's audio track is switched off and on by consent within the aircraft. The crew is heard to respond to requests to switch the 'Audio Off'. At other times the crew say that the 'Audio is On'.

The actions of switching the audio on and off at these times [see FLIR transcripts] is one of disconnecting the audio to the video recorders at a remote switch. The video recorders continue to record without any direct audio input. The audio switches from speech and noise to a near 'flat line' level of audio. All that is recorded during these periods of 'Audio Off' is the noise generated within the video recording system.

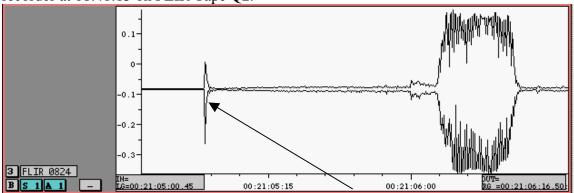
Figure 14 shows the result of the audio on FLIR Tape Q2 being turned off by the operator at 08:24:30 and the subsequent 'flat line' level of audio recorded after the audio is disconnected.

Figure 14 shows the audio being disconnected and the subsequent 'flat line' audio



On FLIR Q2 @ 08:24:30 "Do what .. turn off the audio .. OK"

Figure 15 shows the 'Flat line' audio before the audio data is reconnected to the video recorder at 08:41:15 on FLIR Tape Q2.



FLIR Q2 @ 08:41:15 "It's on"

This type of action within the video system can be detected and recognized by the point at which the audio information is disconnected and reconnected to the video recorders.

I have been provided with 12 sets [24 tapes - 2 from each of 12 machines] of test recordings from the current operational Panasonic machines still in service with the Nightstalker team. The test video tapes have been created to give a template of what each function [Off, On, PAUSE etc.] looks like electronically and physically within different Panasonic machines. It also provides a set of templates to compare any machine operations on the FLIR Q1 to Q5 tapes against. Where necessary I compared anomalous events within the FLIR tapes to the test videos, which provide a reasonable facsimile of what is expected.

It must be noted that there is a 7 (seven) year gap between the production of the FLIR tapes and the production of the test tapes. Whilst the mechanics and electronics of the Panasonic machines may have changed under maintenance and repair, the test tapes do provide a general template of what any electronic and physical events should look like.

The audio information heard on FLIR Q4 ¹¹&¹² is consistent with the 'disconnected' audio heard during the periods between 'Audio On' and 'Audio Off' on other FLIR tapes.

The HD audio track cannot, by itself, be deleted within a Panasonic AG-7400 machine without deleting the original video images as both are simultaneously recorded in 'Depth Modulation' mode. Any re-recording or erasure of the original audio would delete the original video images as well as the HD audio tracks.

As the FLIR Q4 video images are original, the audio on the HD track will have been recorded to tape over the same time period as the video images. Therefore whatever audio has been recorded to FLIR Q4 can be said to be 'original'.

Apart from the interruption at the 10:47:16 to 10:51:57 point, there is no indication that the machinery is stopped, restarted or operated at any other time except to terminate the recording at 12:16:13.

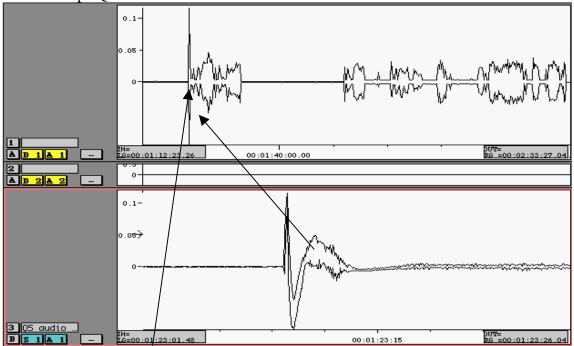
The audio track of FLIR Q4 is consistent with having the audio input disconnected and not providing speech or data input to the video recorders.

There is an electronic difference between the transient (click) at 'Audio on' at 12:16:06 on FLIR Q5 and the 'Audio on' 28 (twenty-eight) seconds later on the same tape. Both transients do not represent of any video machine action such as Record Off, On or Stop. It more likely to be the speed at which the 'disconnection' occurs and the switch characteristics that creates.

¹² Steve Weideman [Henniger Media] says "several minutes wiped out on FLIR [Q4]. Edit had to be intentional, but if it was intent on deception, the FBI could do better than this".

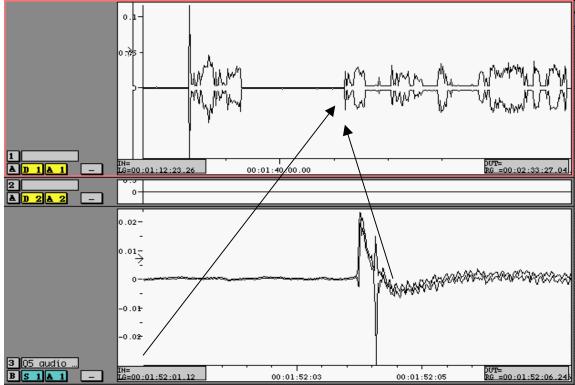
¹¹ Cain says "Q-4's audio track has probably been erased throughout the entire 10:41 a.m. to 12.16 p.m. recording with dramatic increase in sound levels occurring after the picture disappears".

Figures 16 & 17 show the reconnection and disconnection sequence around 12:26:06 on FLIR Tape Q5 with the detail of 1^{st} and 2^{nd} 'reconnection' click/transient.



First 'Audio On' and 'Audio Off' sequence - 12:26:06 - detail of 'On'

Figure 17 shows the second section of disconnection and reconnection of the audio on FLIR Video tape Q5.



2nd 'Audio On' and 'Audio Off' sequence – 12:26:06 – detail of 'On'

The only disruption to the FLIR Q4 audio tracks is at the time the video has stopped recording for a period of 4 minutes and 41 seconds at 10:47:16.

A member of the Nightstalker crew performed a manual operation on the Panasonic machine that was recording FLIR Tape Q4. 13

On FLIR Q4 the frame before the break reads 10:47:16. On FLIR Q7 (copy tape) the time date reads 10:47:15 at the break point. The restart times are similar in that both tapes resume at 10:51:57. It is noted that FLIR Q7 (copy tape) is not terminated until 12:41:07. At that time FLIR Q5 was recording in a machine. FLIR Tape Q7 is not a direct copy of FLIR Tape Q4.

The two parallel Panasonic recorders were in all probability 'Paused' and 'Released' at the same instant, thus creating the 'break' in FLIR Q4 and what would have been the original recording now copied to Q7.

FLIR Tape Q5 follows FLIR Q4 in the sequence of events. The time and date generation on FLIR Q5 is continuous between 12:16:44 and 13:39:07. The tape has recorded both the linear and HD sound tracks but with no speech or data until 12:26:06. The sound level before 12:26:06 is consistent with the 'disconnected' audio level of other FLIR recordings. The audio at this point is switched on and off before being switched on again. This audio control sequence (on – off –on) is accompanied by the crew within the aircraft saying what is happening, The transcript extract from FLIT Tape Q5 has the Nightstalker crew reconnecting and disconnecting the audio data to the video recorder.

12:26:06

*	M	Okay
*	M	All right audio's on
*	M	DED to Charlie-1
*	M	Turn it off a minute Arnie turn it off
*	M	Forward-TOC we got er one -
*	M	<u>Off</u>
*	M	on the grou
*	M	<u>Is it off</u>

¹³ Cain says "it is an apparent insert edit (or equipment malfunction) which also occurs on Q7 but the transition during the edit period is different".

-

12:26:15 [Audio off]
12:26:37 [Audio on]

* M Audio's on

5.3 Conclusions and Opinion

As a result of my examination ¹⁴ I can say:

- ♦ FLIR Q1 has been re-recorded upon at least once.
- ◆ FLIR Q1 has recorded uninterrupted audio between 05:58:17 and 08:00:02, albeit that the speech and data inputs have been switched Off and On [see transcript] by members of the Nightstalker crew at various times. It is an original and unaltered tape.
- ◆ FLIR Q2 has recorded uninterrupted audio between 07:57:51 and 09:28:18, albeit that the speech and data inputs have been switched Off and On [see transcript] by members of the Nightstalker crew at various times. It is an original and unaltered tape and has not been interfered with in any way.
- ♦ FLIR Q3 has recorded uninterrupted audio between 05:59:33 and 07:56:56, albeit that the speech and data inputs have been switched Off and On [see transcript] by members of the Nightstalker crew at various times. It is an original and unaltered tape and has not been interfered with in any way.
- ◆ FLIR Q4 has been recorded in two separate sections [a] 10:42:06 to 10:47:16 and [b] 10:51:57 to 12:16:13. but has not recorded any speech or data information.
- ◆ The Panasonic video recorder responsible for FLIR Q4 was either paused or stopped at 10:47:16. This caused the machine to perform a 'back space edit' at the point of the stoppage. It would have been a manual operation carried out at the machine.
- ♦ FLIR Tape Q4 is an original tape which has had its recording interrupted by a manual operation of the recording machinery. It is an original and unaltered tape.
- ♦ FLIR Q5 has recorded uninterrupted audio between 12:16:44 and 13:39:07, albeit that the speech and data inputs have been switched Off and On [see transcript] by members of the Nightstalker crew at various times. No speech input to the video recorders occurs until 12:26:06. It is an original and unaltered tape.

¹⁴ Cain concludes "Specifically the authenticity of the identified Q1 and Q4 original FLIR tapes remains in doubt as there exists evidence the they have probably been edited and possibly tampered with".

6. FBI video 1050236

6.1 Overview of FBI Video 1050236.

FBI video 1050236 is a recording produced in a hand held VHS camcorder. It records various scenes with accompanying audio. The scenes are separated by camcorder edit points, created by the stop-start mechanism of the camcorder used. The scene of specific interest in relation to this investigation is the video and sound footage during the Branch Davidian complex fire.

The video camera is some distance from the compound but records the scene with reasonably good quality video and sound.

Between approximately 37.42 and 38.52 on the video a series of 5 (five) sharp distinctive cracks are heard. Around the same time various people in the vicinity of the camcorder voice opinions as to what the sounds might be.

The OSC need to determine whether the audio track of the SA Fennwald ground video contains evidence of gunfire. I have been asked to analyze and give an opinion on whether these sounds can be identified as 'gunshots'?

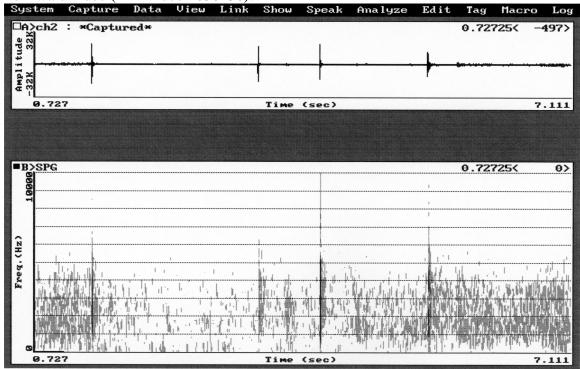
6.2 Analysis of FBI Video tape 1050236

I have carried out a detailed acoustic analysis of the series of 'sharp cracks' heard from 37.42 onwards.

Spectrographic and acoustic analyses of the individual sequence of 'sharp cracks' show a high degree of correlation between them. Each 'sharp crack' has a very similar 'onset' and 'decay' pattern. To the human ear they sound like gunshots. Acoustically and spectrographically they resemble gunshots.

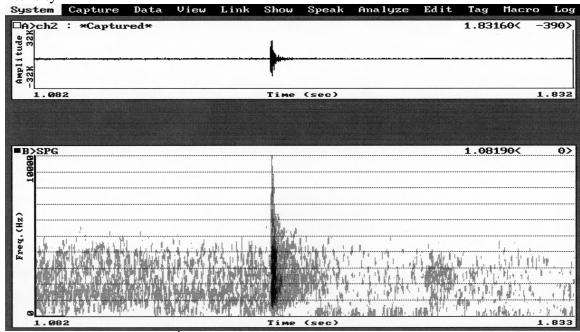
Figure 18, shows the timing relationship between the last four 'sharp cracks' at around 38.48 heard on the sound track of FBI Video 1050236. Figures 19, 20, 21 and 22 show the acoustic pattern of the individual 'sharp cracks'. The acoustic patterns are similar to each other in terms of their frequency, density and timing. There are no sample 'gunshots' available for correlation and comparison. The analysis only allows for comparison of similar events. It does not provide scientific proof that the acoustic events recorded were gunfire.

Figure 18 CSL spectrogram showing the sequence of 4 'sharp cracks' on the SA Fennwald video (FBI Video 1050236).



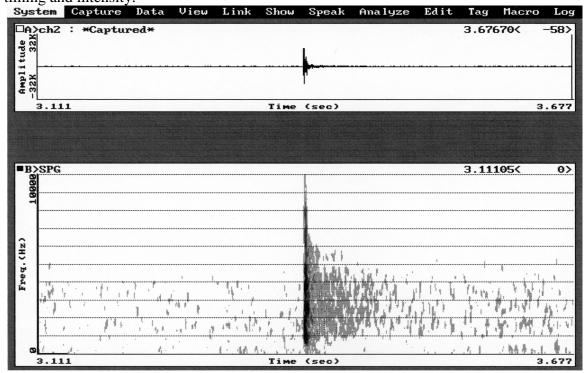
Last 4 of 5 'sharp cracks' around 38.48 - FBI Video 1050236

Figure 19 2nd 'sharp crack of the sequence showing the frequency, timing and intensity.

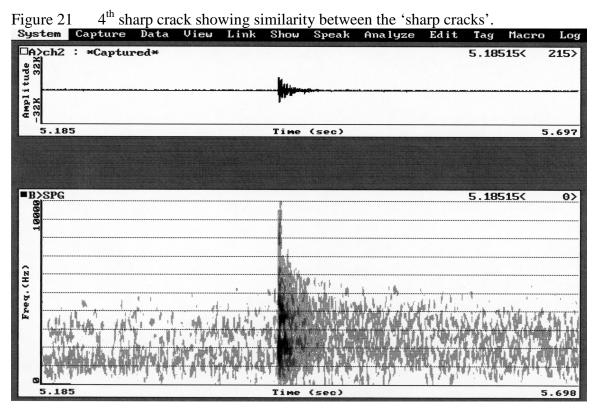


2nd of 5 sharp cracks - FBI Video 1050236

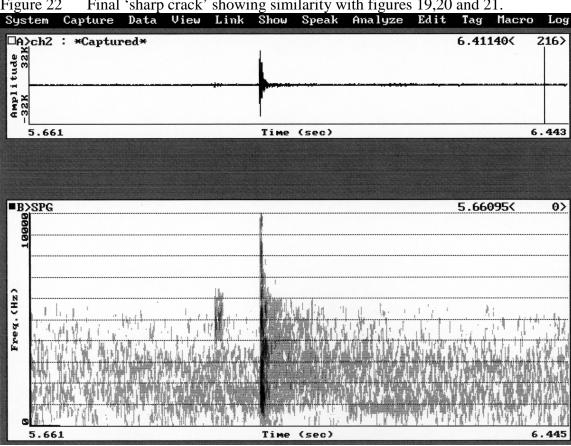
Figure 20 3rd sharp crack of the sequence showing the similarity in frequency, timing and intensity.



3rd of 5 sharp cracks - FBI Video 1050236



4th of 5 sharp cracks - FBI Video 1050236



Final 'sharp crack' showing similarity with figures 19.20 and 21.

5th of 5 sharp cracks - FBI Video 1050236

I have described the sequence of 'sharp cracks' within the transcript as "[Sharp crack - Ammunition discharge]". This is based on previous experience of listening to and analyzing 'gunshots' in various circumstances.

Because of the conditions within the Mt. Carmel compound at the time the sequence is recorded, it is not possible to say whether the [Sharp crack -Ammunition discharge] is ammunition being discharged from a firearm or ammunition exploding involuntary due to heat of the fire. I have transcribed the information available on the sound track of the video.

6.3 Conclusions and opinion

From my examination I can say:

The 'sharp cracks' heard on the FBI Video 1050236 sound track have been described by me within the transcript as [Sharp crack - Ammunition discharging]. Without a reference to compare the sounds with it is not possible to define the sharp sounds as being ammunition being discharged from a firearm.

◆ From experience and acoustical examination of these sounds it is only possible to say they sound and look like 'gunshots'.

7. Additional Title III material

7.1 The OSC has provided 4(four) copy recordings and asked that sections of material be transcribed.

The relevant sides of the 4(four) tapes have been enhanced and copied as follows:

SA 65 - tape 24 [Side A] dated 16th March 1993 -1 CD &1 Cassette - CMM/17 SA 72 - tape 25 [Side B] dated 17th April 1993 - 1 CD & 1 Cassette - CMM/18

SA 72 - tape 28 [Side B] dated 18th April 1993 - 1 CD &1 Cassette - CMM/19

SA 72 - tape 29 [Side A] dated 18th April 1993 - 1 CD &1 Cassette - CMM/20

I have produced transcripts of the requested sections; they are attached at Appendices B1 to B3.

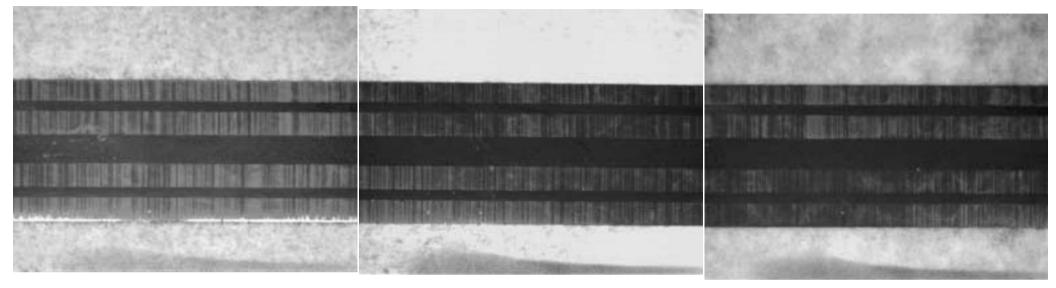
8. Resume

Appendix A2

Chris Mills Senior Audio Consultant



Print Reference: 00053/CMM/4P

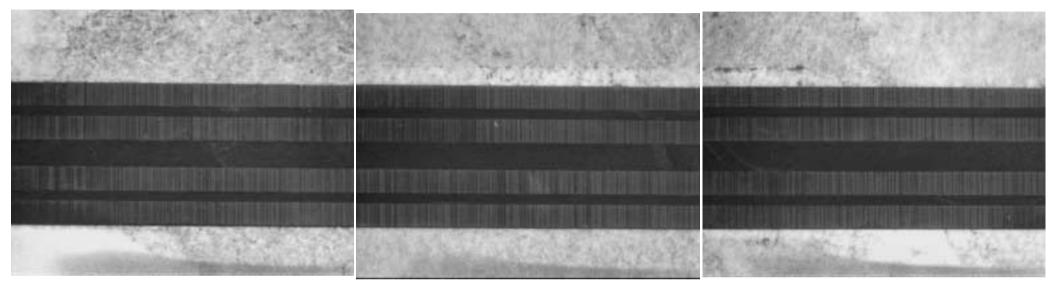




26 Dover Street, London, W1X 4JU. Telephone: +44 (0) 20 7344 8140 / 42 Fax: +44 (0) 20 7344 8121



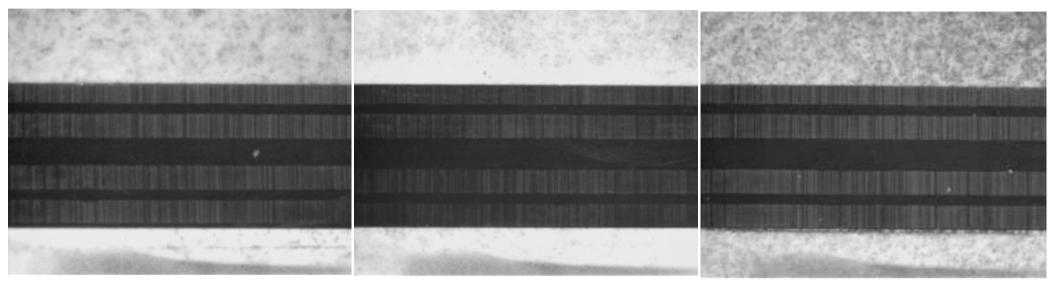
Print Reference: 00053/CMM/5P







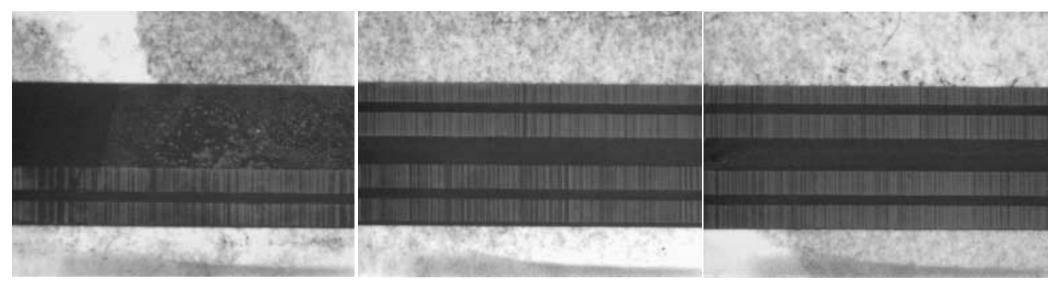
Print Reference: 00053/CMM/6P







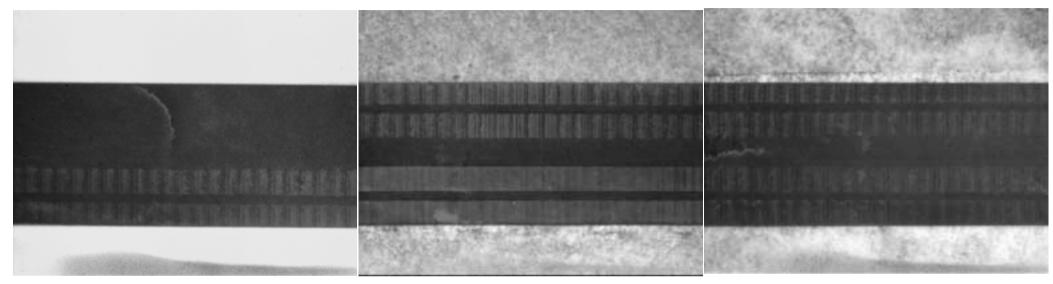
Print Reference: 00053/CMM/7P







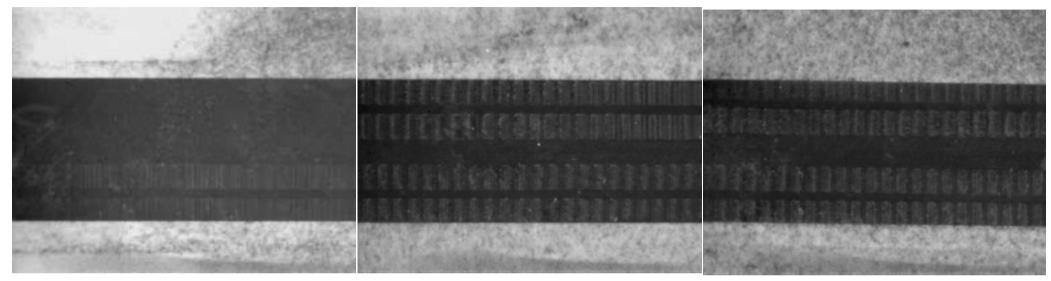
Print Reference: 00053/CMM/1P







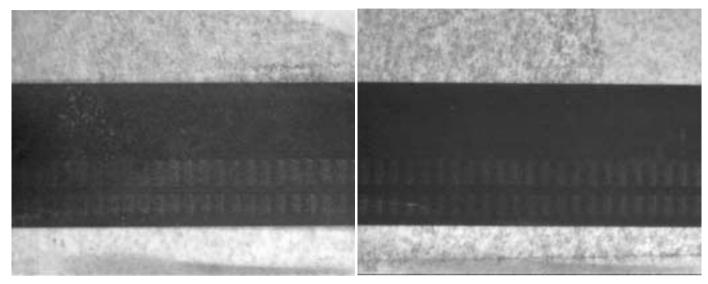
Print Reference: 00053/CMM/2P







Print Reference: 00053/CMM/3P





Appendix A2

C M Mills

Resume

Christopher Martin Frederick Mills

Managing Director & Senior Audio Consultant Network International - Forensic Science Division 26 Dover Street London W1X 4JU

Date of Birth:

7th January 1951

Place of Birth:

London, England

Qualifications:

British Technical Engineering Council – Higher National Certificate in Electrical & Electronic Engineering
BTEC - Diploma in Electronic Engineering
Fellow of the Institute of Incorporated Engineers
Associate Member of the International Association of Forensic Phonetics
UK Law Society listed expert
British Academy of Experts
Corporate membership of the Forensic Science Society

Specialist Fields:

The analysis, authentication, enhancement and transcription of audio and video taped information. Physical characteristic analysis of recording machinery.

Managing Director and Senior Audio consultant, Network

1990 -

Experience:

International Forensic Science Division	
Head of Department - Metropolitan Police (London) Forensic Audio Laboratory	1986 - 1990
Metropolitan Police Forensic Audio Laboratory Higher Communications & Technical Officer	1981 – 1986
Electronics Engineer in the Royal Navy, responsible for the maintenance and repair of Radar, Radio, Sonar, Electronic	1966 – 1981
Surveillance and Countermeasures. His final three years of Service in Polaris Submarines.	

Chris Mills has produced and given expert evidence in hundreds of cases over the last 16 years. During this time he has worked on major criminal cases in the U.K, Europe, Australia and elsewhere. He has provided expert evidence relating to audio/video analysis and authentication in criminal and civil cases as well as military courts and tribunals.

Lab ref	Date:	Client name	Operation/case	Work description	Court
70142	1997	David Eastman	Winchester murder	Analysis and transcription	Camberra Supreme Court
80817	1998	Bloody Sunday Inquiry	Lord Saville Inquiry	Analysis, enhancement and transcription	Londonderry Crown Court
90006	15/1/99	Kent Police	Op Nectarine	Analysis and enhancement	Maidstone Crown Court
80006	15/1/99	National Crime Squad	Op Vortex	Compilation of tapes	N/A
90014	15/1/99	Essex Police		Analysis and enhancement	Chelmsford Crown Court
90022	19/1/99	Essex Police		Analysis and enhancement and transcription & verify	Chelmsford Crown Court
90027	20/1/99	Starling & Bartlam	Graham Shields	Analysis and enhancement and	
)		transcription	
90029	20/1/99	Inland Revenue		Analysis and enhancement	Grimsby Crown Court
90030	22/1/99	Gleneagles Hospital		Analysis and enhancement and transcription	Dundee Sheriff Court
90035	23/1/99	Northamptonshire Police		Analysis and enhancement	N/A
90037	25/1/99	Spymaster		Analysis and enhancement	N/A
90043	25/1/99	Crawley Police	JP Boslem	Analysis and enhance and	Brighton Crown Court
				u anscripuon	
90051	28/1/99	Nabarro Nathanson		Analysis and enhancement	Royal Courts of Justice, London
90026	2/2/99	Metropolitan Police	Chobham	Analysis and enhancement	C.C.C. (Old Bailey)
90062	28/1/99	DERA		Analysis and enhancement	N/A
99006	29/1/99	National Crime Squad	Mammcross	Analysis and enhancement	Ipswich Crown Court
02006	1/2/99	National Crime Squad	Op Granite	Analysis and enhancement	N/A
90075	3/2/99	Norfolk Constabulary		Analysis and enhancement	N/A
90006	3/2/99	Newcastle Police	Op Bullhead	Enhance/download/verify transcription	Newcastle Crown Court
90078	4/2/99	Nottinghamshire Police	Op Odin	Analysis	Notthingham Crown Court
					b

	661710	Broadgreen Police (Birmingham)	Op Glanville	Analysis	N/A
	15/2/99	Hampshire Police		Analysis and enhancement	
	16/2/99	Metropolitan Police		Analysis and enhancement	
	16/2/99	Kent Police	Op Statesman	Enhance/Copy/Analysis	
. 1	23/2/99	Biddle	Raza Hussain	Analysis and authentication	High Court, London
. 1	25/2/99	Beachcroft Stanley		Analysis	
. 1	26/2/99	Pearsons	Farrell McIver & others	Analysis	
	26/2/99	Norfolk Police		Analysis and enhance and	
				transcription	
	8/3/66	BAA Plc		Authentication	N/A
	11/3/99	Langshaw Kyriacou		Analysis and enhancement and	N/A
				transcription	
	12/3/99	National Crime Squad	Op Thistle	Enhancement/Analysis and	Birmingham Crown Court
		Rugby		transcription	
	12/3/99	Farrer and Co	Hassan -v- News	Analysis and enhancement and	N/A
			Group Ltd	transcription	
	17/3/99	News Group Newspapers		Analysis and enhancement and	N/A
		Ltd		transcription	
. 1	22/3/99	Warwickshire Police	Op London	Authentication/analysis and	N/A
				enhancement	
` '	25/3/99	HM Customs & Excise	Op Beatnik	Analysis and enhancement	N/A
. 1	22/4/99	West Yorkshire Police		Analysis and enhancement and	N/A
				transcript	
	14/4/99	Metropolitan Police/4 AMIT	Robe Murder	Analysis and enhancement	Sheffield Crown Court
	11/5/99	West Midlands Police	Op Doublet	Analysis and enhancement and authentication	Central Criminal Crown Court
,	66/9/6	Liverpool	Op Chancer	Analysis and enhancement	N/A

90541	3/8/99	Hertfordshire Police		Analysis and enhancement	
90549	66/8/6	South Yorkshire Police	Op Madras	Analysis and enhancement	
90552	66/8/6	HM Customs & Excise	Op Methuselah	Analysis and enhancement	
90564	12/8/99	Greater Manchester Police	Logan Murder	Analysis and authentication	
90646	10/9/99	Merseyside Police	Op Donovan	Analysis and enhancement and	
			i	transcript	
90650	13/9/99	HM Customs & Excise	Op Haybox	Analysis and enhancement	
90662	15/9/99	Northants Police	Op Norse	Analysis and enhancement	
90810	2/11/99	Metropolitan Police	Op	Analysis and enhancement and	Kingston Crown Court
			Broadway/Nectarine	authentication	
90811	1/11/99	Bark & Co	Finch	Analysis and enhancement and	
				transcript	
90902	30/11/99	National Crime Squad.,	Op Monkey	Analysis and authentication	
		Swanley		33	

Appendix B

[B1 to B9]

Transcripts
Of
Title III Tapes [B1 to B5]
FLIR Video Tapes [B6 to B9]

Transcript

Lab ref: 00053/CMM/17

Tape ref: Enhanced copy of SA 68 Tape 24 16th March 1993

[38.40 to End]

Key:

- .. Natural pause
- Indecipherable
- () Sounds like
- [] Descriptive text
- Continuation of speech
- 0.00 Cassette run time in minutes and seconds
- D David Koresh
- S Stephen Schneider
- BS Byron Sage
- UBS Unknown male
- UF Unknown female
- C Child
- RBM Radio Broadcast Male
- RBF Radio Broadcast Female

```
38.40
UM
       No I think .. I think it worked pretty good .. nobody knows what you're saying
UM
       Yeah
UM
       That was the fact there man ....
[Interrupted and all speak at once]
UM
       ..... 45 .. get a feeling
UM
       ..... wouldn't fight back .. only when they came out and all that .. no one there
       .. yeah come out and all that .. won't bring no tanks .. no .. no .. no .. no .. no ..
       no way .. cos I .... twenty two
38.55
UM
[Background noise]
UM
       ..... God didn't mind
UM
UM
       You're probably talking to em .. you sound er
UM
       Yeah .. that's something that .... all through this they've been rampaging
39.16
[Background noise]
UM
       ..... gonna be pushed for time in .... talking about peace and beauty .. it's a
       betrayal man .. I've heard him myself
UM
       They .. go ahead
UM
       You know .... on there (Brad)
UM
       The point is .. who's beyond them
UM
       Yeah .. like he's puzzled
39.42
[All talk at once]
UM
       Gone down
UM
       In that case
```

UM I think they got it all wrong with me .. like I feel that I've seen the way forward you know UM I'd said my work was finished .. I mean I er .. just what we were I'm gonna hang around .. I'm already .. I'm already gonna show em you UM understand UM You gonna be rejected UM No [Background noise] 40.33 UM I've been over and over it .. I'll just push em back .. had my thumb on the trigger .. fix my mind on a psalm .. take this thing right here and burn it I mean .. they're coming UM They 40.57 UM They fear .. you know .. they really wish us dead you know so bad .. they need to you know 41.03 UM God's hand on us UM God .. with this it is a really happy ending UM Worried aren't ya UM I'd want to stay around .. don't need to stay around .. I think that (Orin's) gone UM Don't have any fresh there's no everything's going down the hole 41.34 UM They are also like it down the street .. they'll be calling right 41.42 UM Tired UM just like I told em UM That's what I was saying

UM

..... you know

UM The ... didn't even know these things

UM No

41.57

UM To make your point .. we give him hand

[All speak at once]

UM According to the prophets I'm .. tell him aint no fun here

UM David you know it's wrong .. that's my advice to you .. you know it's wrong you go and ask the prophets that you away to that man of twenty-two he's all heart in fact .. prophecy is I haven't even seen him yet

42.24

UM I think we'll use them real soon you know .. what do you think

UM I wanna tell ya now but um

42.32

UM I mean I tell you exactly what I was doing when I'm asking him I was trying to and I've gone huh huh .. when I was in there you know the stuff was like coming on .. you know .. he says er Dave er the guys wanna know if they could have a smoke .. now wait a minute

UM Yeah but er go ahead .. it was like .. you know a bit like .. my God they like me

UM I will not be caught .. you know I mean and that's exactly sees himself .. he's impatient though

43.16

UM You know .. time them was on this er .. this I wanted .. I wanted .. I wanted to tell you

UM Well actually you know whey we're doing it on the time when I .. you know all that

UM I'm gonna .. uh .. I figured you know God will (manage) it you know that

UM I guess you're right you know what I mean

UM You know he's gonna tell me .. when he's coming you know

UM Some men are worse than me UM I hear em UM Initially when I read in between my mind .. there is you know er .. I used to use that kind of kinda like .. you have to wish that in your life UM Don't owe me a thing UM It all tells the people t hat 44.14 You know that last thing I did in there you know UM UM I don't know anything .. I wish everyone would pray to be .. really hard UF Will we get out UM Is the other gas er lethal [All speak at once] UM tell em where they [All speak at once] UF ... praying .. I just .. I just come out and say it UM They are warning you .. you playing ball UM He's (mine) .. you hear people saying things [Tape runs out]

Transcript

Lab ref: 00053/CMM/18

Tape ref: Enhanced copy of side B of SA 72 Tape 25 - 17th of April 1993

[16.00 to end of side B]

Key:

.. Natural pause

.... Indecipherable

() Sounds like

[] Descriptive text

- Continuation of speech

0.00 Cassette run time in minutes and seconds

D David Koresh

S Stephen Schneider

BS Byron Sage

UM Unknown male

UF Unknown female

C Child

RBM Radio Broadcast Male

RBF Radio Broadcast Female

```
16.00
UM
       .... sure the injury just hurts for a bit .. til we get ..... between (Gary) and all of
       his men .....
UF
       But yeah but
UM
       If he does it first .. he'll get his (promise)
UF
       I don't know where he stands .. yeah I mean we could just do that .... so
UM
       Well .. it's not as bad ..... owing (favours)
UM
       I thought he reckoned ....
UM
       Well listen the lines .... stand down
UM
       Well I don't know why he hasn't answered at all
UM
       Well you don't think .. what do they call it
[Background speech]
UM
       He won't answer it
UF
UM
       There is no point
16.58
[Movement noise]
17.03
UM
       Why ... hasn't he forsaken him
UM
       I mean .. even if you are patient and have a greater experience
UM
       I can't imagine how he is .. I don't know why .. I guess .. doesn't seem like we
       should really get out of here so easy
UM
       .... since 1980
[All speak at once]
UM
       I would not personally think of ....
UM
       Suppose to be me and God
UM
       That's true
UM
       We can't go down
UM
       That true
```

UM I think after that .. nothing .. only to you I [Male laughs] 17.40 UM Well I like that .. after all he nearly got ... he did UM Guys .. you planned it UM I can't remember that UM I don't know but er UM If I did .. I must have a been on something [Laughter] 17.55 UM They told me plant it right up the top that's what it says UM Then you will ask for strength .. about ten years .. they decided to come .. to come down here UM No that didn't really need help UM Got a family .. you got it .. you tried to ... [Laughter] 18.17 UM ... I definitely didn't know .. but I better get down there .. couldn't wait any longer UM You're .. you're good for .. sit down .. what's where's (Rianne) your sister UM Yeah .. do you know .. she's a lot like her UM Yeah UM Oh gee er .. very .. she's a lot like her [Background speech and movement] 18.40 UM Boy .. she's like me .. she has a lot things .. she's throwing away furniture she didn't like UM She always does it to get herself out of trouble .. had to move around and stuff

SA 72 Tape 25 Page 3

.. and follows everything she can find to improve to be comfortable

UM Er did it ever occur to her that she

UM See why she couldn't have got out I mean boy

UM Oh .. when I came through out here cabinet I came through and asked .. she did .. she tried and tried and couldn't get the guy .. then she was .. she got told of Jack

UM What was she doing with (Guy)

UM I dunno .. but she wanted him .. that was the whole thing .. and she said could you have a way to get a hold of em .. well she didn't .. and so all she asked how to get hold of him and get back to me and she was thinking about trying

19.23

UM And now they've reported Gary .. came out of the tower

UM Right

UM Not running or ... he bought it up

19.53

UM We forgot to give her any of the we don't get it ... one first time

19.55

UM Because that ... is in overtime

20.00

UM We can't both have it

UM This is true

UM saying the interpretation

20.15

[Sound source change]

[Increase in background noise]

[Background noise]

UM That would be great in my speech

UM Ah [laughs] .. that's how I really found out

UM It would have been nice too .. you know the water all around the place

[Background speech]

UM

Oh for sure

[Background noise and background speech]

```
21.01
UM
       Gary did good okay (Jeff)
21.06
UM
       That would help with us .. (RMS) factory .....
UM
       .... sure that would be a lot .....
UM
       Really .. if we are gonna watch ....
21.18
UM
       Could roll into (AO)
UM
       See I'm going Graham .. they have their work cut out for them
UM
       On the (Golden Chariot)
       Where's Pablo and Jeff
UM
UM
       I haven't
UM
       Which Jeff
21.40
UM
       My guys
[Background speech and background noise]
UM
       Tend not to do it (though)
UM
       That's a problem .. yeah .. yeah .. well
UM
       I think they're already fixing (it)
UM
       Yeah ....
21.53
[Background speech]
21.54
UM
       .... would never have given em .... (a book on it) .. guys would never have
       learned .. because of this (Greg) .. I should have probably let (em) go ... the
       other day when he showed .. he went round there ... he might have shot the ...
       the question is now .... time
SA 72 Tape 25
                                                                              Page 5
```

```
[Background speech]
22.20
UM
       Okay we gotta put down a ...
UM
       What me in the (nose) with this
UJM
       Er that it
UM
       Yeah
22.32
[Background speech]
       .... staying for her .. can't help that
UM
[Background speech]
21.42
UM
       Yeah we kinda (asked) on one day
UM
       I'll ask ....
[Background speech and movement noise]
22.48
M
       They ought to get into .... that
UIM
       They haven't recovered .. (Linda) is in a pretty ... got it all ....
23.07
UM
        ... checking over everything
[Background speech]
UM
       Well what you gonna say .. dear Michael I don't know why she's fucking say
       this .. they are gonna take plenty more action .. they want to confront me .. a
       battalion .. sure they want to shoot okay ..... grab this .. so that they've got
       their guy .. that's .....
UM
       All I know is .. they did to Michael I don't know
23.41
UM
       Twenty-five millimetre in exchange for radio and a (van) .. twenty five dollars
       they don't pay
[Background speech]
```

23.55

UM And then ... next they put a firebomb in with the .. it's got a .. got a about this long .. stayed around .. they will (show) us .. go out with

24.12

UM They have a personnel carrier .. that they have taken in to any confrontation to (break) this place down

24.25

UM I felt it .. er it did er to Paul's EL-Camino .. they crunched that .. did you see that thing after .. they kinda just drove over it that's the effect they have on cars .. especially if they do it with (tractors)

UM Don't say well er

UM/F And the thing is this .. you know that they're planning on er putting everyone in prison for life .. otherwise they wouldn't do this

UM Oh yeah I know it .. I got that to .. why would

24.52

UM/F Is .. is everyone's belongings .. the property and you know you can't retrieve back er things that are er

25.00

UM/F Why do it

UM Exactly .. exactly .. it's too bad .. I told them that about my life .. but brought up certain things with those guys last week .. I I said that was all over for that .. you can't replace that

UM It was an 84 (Omega) they don't make them any more

UM We'll make (plans)

25.24

[Background speech and movement noise]

UM You're definitely right .. I think all the time he knows it .. nobody comes in here

UM/F Make sure that they can come in

```
UM Exactly .. we're all ....
```

25.48

UM Cold

UM Boy they took fire .. catch fire and they couldn't bring the fire trucks and they couldn't even get near us

UM Exactly

[Male laughs]

UM They could have had you get out there you know but er .. this is good

UM Boy

UM They're building up the (heat) each time obviously

UM This is

26.22

UM I think if we have to get out .. then we'd have 5 (five) guys or six guys .. boy are they building up heat .. each guy with an automatic .. just ... force the guys out of the tanks you suppose .. gonna have to keep them .. all the women and children going down

[Male laughs]

[Breathes into gas mask?]

26.31

UM He'd have to have a couple of girls you know ready to replace the guns as they got hot

26.37

UM/F No .. they'll probably use on tanks at a time

UM Yeah and fool us .. funny how other ... one

UM Oh yeah .. I mean I think I meet the guy on the wire soon .. okay she remember the other night .. why do it

UM This guy .. you're right Steve .. listen to me and

26.55

UM And I tried because

```
UM/F Stopping it
UM
       All right they won't give me ....
27.02
[Breaths through gas mask?]
UM
       I've gotta protect them .....
[Breaths through gas mask?]
27.15
UM
       Fifty have already gone you know
UM
       All right they only .... those guys would probably just go ... away
[Background speech]
27.32
UM
       They really did .. they did
UM
       What have you heard
[Background speech and movement]
27.50
UM
       Better to go through the system
UM
       Ah but I'll tell you
UM
       Yeah .. yeah .. yeah
UF
       [laughs]
UM
       No I could see myself sitting there .. in prison for the next 20 years waiting to
       be tried
UM
       They've got to be .. but not that
UM
       I'd convert (bubba)
[Female laughs]
28.15
UM
       That's like in another class .. your heart will hear concerns about (bubba)
UM/F I got it too
UM
       Good guys
UM/F I bet he still don't come
```

UM Basically use the word (bubba) .. he ain't gonna let you down UM I think that I do too 28.30 UM If he lies he'll tell [Background noise] 28.39 UM We'll get (Bob) go ... the air UM Against the short (hole) UM At the short hole right here .. they surely after us UM Matter of act the first of (crop) right her UM Yeah big shortage of ... we'll have to shift it back there UM/F God 28.57 UM Who UM/F I remember UM Do you think UM You better take a also [Background speech] 29.05 UM Do you know if they've got half share here .. just let me know UM Ruth is not too bad is she UM She sure is (bitchy) though UM I think so UM/F As fast as she has not [Background speech] 29.27 UM She's got pretty good with me so that can't hurt 29.33 UM I thought .. d'you remember that guy with his ...

```
UM
       Oh yeah
UM
       .... he got him with that .....
UM
       .... but all she's doing is getting pregnant
UM
       Yeah but .. yeah why did she just ... him
UM
       He acted like er he .. well I suggest .....
UM
       You know cos it's all to do with er (Charlie) and er
30.03
UM
       We .. we go ....
UM
       Well if you're afraid .. I'm afraid you go
30.10
UM
       Course our strength is the ... ourself
UM
       Well maybe I can see ....
[Male laughs]
UM
       God uh uh
30.23
UM
       God
UM
       What you in love or something
UM/F Well if he was .. let him go out
[Background noise]
UM
       A little Chinese
UM
       You know I was just thinking the same thing ... it's ....
UM
       Oh yeah she does .. she doesn't know anything about him
UM
       . . . . .
UM
       Really .. I guess
31.00
[Background speech]
UM
       We could ..... the (staff) in Japan
UM
       As cold as ice
UM
       Yeah .. she's Malaysian isn't she Malaysian
```

```
UM
       I know that woman
[Male laughs]
UM
       See I don't mind her there
[Background noise and background speech]
31.20
UM
       .... don't have to worry .. you're scared .. everybody's scared
UM
       Whoa .. whoa God ... oh whoa God
UM
      I hear ya
[Male laughs]
31.27
UM
       ... with them
UM
       I'm sure people couldn't give .. right .. am I gonna get an answer
[Laughter]
UM/F Oh great
UM
      Devil God must forgive
UM
       Gladly .. oh hey Major
UM
       Thinks .... everybody takes the way we .....
UM
       Away with it
UM
      HE has
UM
       Everybody takes away sin .. I think even God .. he's definitely (sick)
UM
       I wonder what God's saying right now
UM
       He's laughing .. try to work out .... answers .. but he needs more experience
yet
32.11
       No .. but you thinking nobody lies ya
UM
UM
       It's not true
UM
       He got to (earth)
UM
       That's right there .. so he did (write)
32.20
```

UM His name was 32.25 UM What is this sinner UM Story shows that when he UM Yeah I like that UM Never said as many as that UM 32.38 UM Oh help me UM Feel (thy) only work on the fails Don't think we probably need to everything UM [Increase in background noise] 32.55 UM Bands coming 33.00 UM How does it work

Transcript

Lab ref: 00053/CMM/19

Tape ref: Enhanced copy of Side B of SA72 Tape 28 - 18th of April 1993

[35.00 to End of tape]

Key:

.. Natural pause

.... Indecipherable

() Sounds like

[] Descriptive text

- Continuation of speech

0.00 Cassette run time in minutes and seconds

D David Koresh

S Stephen Schneider

BS Byron Sage

UM Unknown male

UF Unknown female

C Child

RBM Radio Broadcast Male

RBF Radio Broadcast Female

```
35.00
[High level of noise]
[Phone/line ticking]
[Various changes of sound source – no speech]
[Various noise and sounds recorded]
36.01
[Sound source change]
UM/F Yeah well
UM
       I hope so God .. I hope so
UM/F Want filling up
UM/F Anything good
UM
       I think that .. it maybe scary
UM
       Oh yeah okay .. ... it maybe scary
UM
       Oh yeah okay .. ... the way in
UM
       Yeah well you've been hearing he's been saying about that for 2 or 3 days ...
       now we're making efforts I think .. he did say that .. we'll make an effort if he
       goes back on that
UM
       I said that is my position now
36.27
UM
       You always wanted to be a charcoal briquette
[Laughs]
UM
       He told em .. he goes .. you your prophecy will be ..... [chuckles]
36.37
UM
       That's your price if you take that
UM
       I hear your prophecy not going to say nothing happened er they're never going
       to say this to my ....
36.47
```

SA 72 Tape 28 Page 2

I know that there's nothing like a good fire to bring us to birth

UM

UM

I know it

```
UM/F Oh I was getting a little ......
36.58
UM
       Ow .. ow .. ow .. ow .. ow
UM
       My impression of the first man landing on the sun
UM
       Ow .. ow .. ow .. ow .. ow .. ow
37.08
UM
       Yeah got it right
UM
       Darn our controls are jammed here .. here comes Mr Sun
UM
       Are you gonna make a phone call tomorrow .. are you gonna try or .....
[Background speech]
UM
       Do they keep water in the thing until you get started
37.19
UM
       Wow
[Background noise – no speech]
UM
       They sure .... on the ...
[Background speech]
37.40
UM
       They think it's gonna help anyway ....
UM
       Thinking you go fetch some water if you want want
UM/F They told me to go to see if ....
37.50
UM/F All right
UM
       I say .. I say if you're asking me
UM/F Hey yeah
UM/F I mean .... doesn't touch his (soul) if you know what .. why didn't he do it
38.01
[Background sounds]
UM/F ..... through our feelings
UM/F I see but they can come in and try and .... (crush em) with a .... won't get ....
```

- UM/F No .. I don't follow why
- UM/F I mean if they (kill) Billy now I mean .. you know what I mean
- UM/F Don't ask me what's going on
- UM/F We're going nowhere .. I mean we can't .. sorry but it's wrong to have (control) you know what I you can't .. you are not gonna have (both) consent
- UM/F What do you do then because they bothI mean it doesn't have to be like that .. if we adjust to
- UM/F Right .. well yeah .. like he says and they .. they have planted the seed for your (escape)
- 38.46
- UM/F Our escape [laughs]
- UM/F Everything you can see in the book is
- UM/F Got to get rid of all that writing
- UM/F When they come in .. I'm gonna see if they're real
- UM/F Yeah .. not yet
- UM/F I think you need to really read it and you'll see
- UM/F All listening to (the fire) anyway
- UM/F Yeah .. he's writing in here and this is
- UM/F Isn't it all
- UM/F He aint said he's done .. in fact what he said .. I don't know if I'd have em from mocking God .. in fact he'd been refused
- UM/F Well if he was refused
- UM/F Maybe the (spirit) that they put down in front of us .. as you know there .. there .. I took the weight of this
- 39.32
- [All speak together]
- UM/F I want to
- UM/F Yes .. we'll all come in here

UM/F You know what .. you know in Isiah there a UM/F Yeah I mean you all talk about this day .. amazing .. it is like UM/F What .. express to me what it means .. I don't kneel .. they'll even tell ya UM/F Here .. here .. here 40.04 UM/F Can't be near him it's right .. it's right .. you find out when you know him better eh UM/F What you're going back [Background speech and noise] [Someone tests "broadcast" system] [Audio breaks up] [Feedback of audio] 40.31 UM/F was she saying that or maybe serious UM/F I don't know .. I just know as much as you know UM/F Isn't it strange that UM/F I wouldn't say that no [Feedback from audio] [Background speech] UM What do you say .. I gotta get onto Sage UM All these books .. no one's to mention your name .. it's not here UM Scott 41.08 UM What's up [Somebody whistles] 41.23 UM It's really nothing [Laughs] UM I always felt that they are ready

UM Why are you a

[Laughs]

UM boy .. wait til I get my scrawny hands on your scrawny little neck .. I'm coming back and when I do you are gonna .. cos there's nowhere you're gonna be able to hide

UM Yep

UM ... you're gonna lose whenever .. a hundred years with any luck

UM No hey .. hey I'm gonna hear any of that

UM ... great .. Jeff can come right on up

42.15

UM Oh you do .. you want to lift the the bottom up

UM Really

UM Yeah

UM Or .. one .. two

[Background speech]

[End of section]

Transcript

Lab ref: 00053/CMM/20

Tape ref: Enhanced copy of SA 72 - Tape 29 - 18th of April 1993

[14.45 to 25.00]

Key:

.. Natural pause

.... Indecipherable

- () Sounds like
- [] Descriptive text
- Continuation of speech
- 0.00 Cassette run time in minutes and seconds
- D David Koresh
- S Stephen Schneider
- BS Byron Sage

UM Unknown male

UF Unknown female

C Child

RBM Radio Broadcast Male

RBF Radio Broadcast Female

14.45

[Background noise]

14.50

UM You'll never even been er charged with anything

UM Threatened with er

UM And everyone everyone's reading er ...

UM Was it really .. like what

UM He can tell things .. always always reading

UM Really

UM Cos he had no TV

15.23

UM God

UM And only ... we need to be straight with me

UM We're gonna leave for

UM Too fucking right

UM Okay .. even though they've decided to go out right

UM Yeah .. you come out looking like a

UM It maybe up to me

UM I mean I'm telling them .. if you want to we will respond yeah

UM Basically one of them is certainly

UM No

UM He's all right .. he's not all that jolly

[Background noise]

UM Far from perfect

UM I really didn't like God a whole lot okay

UM Well I hope you didn't do any wrong bad things and I hope you didn't

16.38

UM Somebody said you wanted me .. someone else has left .. I don't know

UM Can't understand why you treated God as I don't know

UM Probably you that's doing it UM Can I assume it's natural UM Just saying .. you know UM Starting over unless UM All these things are set up ready to go then aye UM Sure UM Huh UM Just the one thing needed UM Do we need a cable yet at this stage UM Did we get a cable UM No .. we got a cable ... UM Oh Graham UM Yeah UM So they are not totally set up yet Gonna tie those two that's it UM UM That's all UM Yeah UM Okay UM This one has a UM I believe it that that we can peel back the plastic .. and then they jam UM Jam the whole damn UM Jam it .. pull it up at the .. we got to get the desk look away back up there I'd like to get it way past twenty .. twenty UM Maybe we can get it back a bit UF Steve .. David you go test .. test .. test [whistling] [UM chuckles] UF What to do for five by five or three two one UM That what they did five four three two one UF Yeah

UM Yeah yeah UF Okay UM This is the midnight girl how you doing UM Oh yeah yeah UM [Chuckles] UM [Chuckles] UM Can we have something imaginative then UM Check this out Ronnie get down there [whistling] [All speak at once] UM ... oh God well we got UF I know this UM De de de de de .. I'm willing to send that UM ... Ronnie .. Dave UM Yeah yeah UM Yeah round the exit UM They have to break in and drive round UM They seem to know [Overlap of speech] 18.30 UM Make sure we can get em maybe UM I don't know UM I got air Yeah you check out the window there .. you know that part it's been (wrecked) UM UM They up in the tower UM Yeah got up to the tower .. where are they .. oh yeah I look out UM Well let me know oh .. anybody's going up here let them know they can look out the windows yeah and tell them that okay

SA 72 - Tape 29 Page 4

UM

UM

Yeah .. it's a break

They know that (hole)

UM Yeah .. Graham came up and told us UM Who's up there tonight .. it's usually UM Neil UM And Rick UM Mind you er UM Are dealing (er you know) UM Rick already went out you know in the Tower tonight UM Yeah UM Yeah you have to be for them to tell nobody in the tower any more UM Why's that UM It's the box seem UM Yeah you know I like ... somebody did .. did did we .. do you understand .. I understand pretty well .. it's not even finished yet [Male laughs] UM Okay UM Yeah UM Talk to them just like this real slow and like you know who and I think he has (Wayne) and I'd like to heeded .. and the other thing I'd like is to be he said no (E) this you have no jurisdiction here .. this place here we have run it long before you been around and over here sitting wherever you are .. it's gonna continue to be keep going our way UM UM And the only thing I can advise you if you don't want it to go God's way .. you can come right in with your tanks your burn it or whatever else I really don't care .. in the first place .. I really think the rest will heed it UM No UM They they told em UM Oh he's been UM

UM No no Steve don't get rash

UM I talked to em very easy like that .. I said that he told us nobody in the tower any more

UF Oh here .. yeah

UM And that's what I said I I said to em real easy .. said not that I heard you it's not to be heeded-

[Child's voice in background]

-you will not dictate to this group where we will be and and in fact I advise you not to get any closer than you already have .. er you should be surprised and you didn't really surprise us but you came into the building .. you do things like that you might as well keep right on with all your tanks

UF I bet they

UM Huh

UF I think the tanks are still

UM I don't know maybe on the level of I don't know .. probably

UM ...

UM Do you see that there

[Child's voice in background]

UM Right here down .. do you see that do you know what that is there .. do you know what that's for

UF Hm no

UM You don't huh .. it's for the people that are here you know Joel 2 and Isaiah 13 .. who's faces are like flames

UM I was always wondering how that was brought about

UM So they must be burning in

UM It is Isaiah 33

UM 33 shh

UM Huh

UM ... scriptures

S Yes it is UM We will run from the fire .. we will burn UM You want to wait for me UF And God said to do this UM That's what David said they'd done then fine with me UM David's in line with these UM All his ways are directed as far as I am concerned and if he goes down UF I'm just wondering if that's what he said Yeah that's his er direction right here-UMUF Is that it UM Walking out of the room that's UF That's no fun Oh no nothing ever is but you can tell we're all here from February 28th-UM UM Unless you're in they can't UM -that's the idea you know really UM Pretty much reckon UM Judie's become like (Brad French) always pointing at everybody [Male and female laugh] UM Same finger UF [In background] Well tell them that they took away the telephone it's not easy to ward to .. Ray come out and they'll all standing in lines .. we do not know about that empty one UM Heard from Daniel UF No he's UM Why UF I don't think he's very you know if they keep arresting our people and when then when they give us you know UM I'd tell him it's crazy UF

UF Well we can use that

UF Yeah they know we didn't plan to be I don't even know

UM Wanna check if this boxed is bugged Graham

UM Oh I'm not gonna tell them that I'll let

UM They're liars

UF The thing is you've heard from one guy like the

UM Yeah you never know they could come .. hard to work it (out)

[All speak at once]

UM Want a (knife)

UM Graham want a knife

[Background speech]

[End of section]

Transcript

Lab ref: 00053/CMM/13

Tape ref: Enhanced copy of 72 Day 11 Tape 30

Key:

.. Natural pause

.... Indecipherable

() Sounds like

[] Descriptive text

- Continuation of speech

0.00 Cassette run time in minutes and seconds

D David Koresh

S Stephen Schneider

BS Byron Sage

UM Unknown male

UF Unknown female

C Child

RBM Radio Broadcast Male

RBF Radio Broadcast Female

0.00 [Background & movement noise] 0.40 [Music in background] 1.07 [Background noise] [Music stops] [Sound source changes] 1.40 [Background speech] 2.05 [Audible tone] 09.35 [Audible tone] 12.19 [Intermittent Audible tone & movement noise] 14.58 [Intermittent Audible tone & movement noise] 16.12 [Audible tone changes & then ceases] 18.23 UM [Audible tone & background noise] UM Well that's for the -18.50 [Audible tone] 21.07 [Telephone Ringing] 21.30

[Telephone ringing]

UM Hello .. hello

BS Hello is Steven there

UM I can't hardly hear you

BS Is Steve there

UM Er no he's .. he's asleep right now

BS Well you need to wake him up .. this is Byron Sage .. this is a very important call

UM Er .. well sir he asked not to be bothered now .. because you realise today has not been a happy day today but

BS I understand but you need to get him up

UM I am gonna go and check if he's awake .. hold on

[Telephone handset put down

[Footsteps]

UM We're not gonna disturb him

25.45

UM Right here .. I can hardly hear you

BS Can you hear me now

UM But very weakly

BS Okay this is Byron Sage .. I need to advise you very important .. understand

UM I can hear ya

BS Okay we're in the process of placing tear gas into the building .. this is not an assault .. we are not entering the building do you understand that .. this is not an assault

UM You are going to spray tear gas into the building

BS In the building we are not entering the building .. this is not an assault .. do not fire your weapons .. if you fire .. fire will be returned

UM Everybody grab your masks .. everybody grab your masks

[Movement noise]

BS Steve David individuals outside the branch Davidian compound .. we are in the process of placing tear gas into the building .. this is not an assault .. this is not an assault you we will not be entering the building .. this is not an assault .. do not under any circumstances discharge your weapons .. if you fire .. fire will be returned .. do not shoot .. this is not an assault .. the gas you will be smelling is a non-lethal tear gas

UM - ... tear gas ...

BS This gas will temporarily render the building uninhabitable .. exit the compound now and follow the instructions of the individuals who will talk to you from the Bradleys .. you are not to have anyone in the tower .. the tower is off limits .. the tower is off limits .. no one must be in the tower .. anyone observed in the tower will be-

UM - everyone out the tower ...

as an act of aggression and will be dealt with accordingly .. if you come out now you will not be harmed .. follow all instructions .. come out of the compound with your hands up .. carrying nothing .. come out of the compound with your hands up carrying nothing .. come out of the building and walk up the driveway .. towards Double D Ranch Road .. walk towards a large red cross flag near Double D Ranch Road .. follow all instructions of the FBI agents in the Bradley vehicles .. follow all instructions .. you are under arrest .. this standoff is over .. we do not want anyone to be hurt

UM - Where's Steve

BS Follow all instructions

UM - We have to wake ...

BS This is not an assault-

UM - We have to wake him

BS - do not fire any weapons .. we do not want anyone hurt

UM - the phone

BS The gas will continue to be delivered until everyone was safely out of the building .. exit the compound now .. David Steve those of you remaining inside the Branch Davidian complex is it time to surrender to the proper authorities .. we do not want anyone to be hurt .. follow all instructions .. this is not an assault

UM - What ever you got on ...

BS Do not discharge any weapons .. we do not want anyone to be hurt .. the gas will continue to be delivered until everyone is out of the building-

UM

exit the compound now .. anyone appearing in the tower you are to be advised there is to be no one in the tower .. the tower is off limits .. be advised the tower is off limits .. you are warned no one is to be in the tower .. anyone observed in the tower will be considered to be an act of aggression .. and will be dealt with accordingly .. this is not an assault .. we are not entering the building .. we are in the process of delivering tear gas into the building .. this is not an assault .. do not fire your weapons .. if you fire fire will be returned

UM -

BS Do not shoot this is not an assault

[Pause in speech]

UM - ...

BS The gas you smell is a non-lethal tear gas .. the gas will temporarily render the building uninhabitable .. exit the compound now and follow instructions .. you are not to have anyone in the tower .. the tower is off limits -

31.20

[Change of sound source]

BS - no one is to be in the tower .. anyone observed in the tower will be considered to be an act of aggression and will be dealt with accordingly .. if you come out now you will not be harmed .. follow all instructions .. come out with your hands up carrying nothing .. come out with your hands up carrying

nothing .. come out of the building and walk up the driveway towards Double E Ranch Road .. walk toward the large Red Cross flag .. follow all instructions of the FBI agents in the Bradleys .. follow all instructions .. you are under arrest .. this stand off is over .. don't want anyone to be hurt .. follow all instructions .. this is not an assault do not fire any weapons .. this is not an assault do not do not fire any weapons .. we do not we do not want anyone to be hurt .. gas will continue to be delivered until everyone is out of the building .. exit the compound now .. submit to the proper authority David Steve .. give us a call at the negotiation room so we can work this thing out

[No speech]

[Background noise]

[Machine OFF/ON from Pause]

32.54

BS David Steven those of you remaining inside the Branch Davidian compound ... this is Byron Sage we've been talking for 51 days now .. we need to .. bring this matter under control .. this is not an assault .. we are in the process of placing .. tear gas into the building at this time .. this is not an assault .. we are not entering the building .. we are not entering the building .. this is not an assault .. do not fire your weapons .. if you fire you will be fired upon .. do not shoot this is not an assault .. the gas you will smell is a non-lethal tear gas .. this gas will temporarily render the building uninhabitable .. exit the compound now .. and follow instructions .. exit the compound now and follow instructions .. you are not to have anyone in the tower .. the tower is off limits .. no one is to be allowed in the tower .. anyone observed in the tower will be considered to be an act of aggression and will be dealt with accordingly .. if you come out now you will not be harmed .. follow all instructions come out with your hands up carrying nothing .. come out of the building and walk up the driveway towards Double E Ranch Road .. walk towards the large Red Cross flag .. follow all instructions of the FBI agents in the Bradleys .. follow

all instructions .. you are under arrest .. this stand off is over .. you are under arrest this stand off is over .. we do not want anyone to be hurt .. follow these instructions .. this is not an assault .. do not fire any weapons .. do not fire any weapons .. we do not want anyone to be hurt .. gas will continue to be delivered until everyone is out of the building .. exit the compound now

35.44

[Faint ringing sound in background]

[Pause in announcement]

42.16

BS

Steve David and the rest of the Branch Davidians .. we are in the process of placing tear gas into the building .. this is not I repeat this is not an assault ... we are not I repeat not entering the building .. this is not an assault .. do not fire your weapons .. do not fire your weapons .. if you fire fire will be returned do not shoot this is not an assault .. the gas you smell is a non-lethal tear gas .. this gas will temporarily render the building uninhabitable .. exit the compound now and follow instructions .. you are not to have anyone in the tower .. the tower is off limits .. no one is to be in the tower .. anyone observed in the tower will be considered to be an act of aggression and will be dealt with accordingly .. if you come out now you will not be harmed follow all instructions .. come out with your hands up carry nothing .. come out of the building and walk up the driveway towards Double E Ranch Road .. walk towards the large Red Cross flag .. follow all instructions of the FBI agents in the Bradleys .. I repeat follow all instructions .. you are under arrest .. you are under arrest this stand off is over .. we do not want anyone to be hurt .. follow all instructions .. this is not an assault .. do not fire any weapons .. do not fire any weapons .. we do not want anyone to be hurt .. gas will continue to be delivered until everyone is out of the building .. exit the compound now .. surrender to the proper authority

44.34

[No speech]

[Microphone click]

44.38

BS Steve David we're attempting to contact you via the telephone er .. attempt to initiate contact telephonically with the negotiators .. if you cannot do that .. if you cannot do that if the lines have been cut indicate with the flag er out the front door .. once again do not do not .. send anyone into the tower .. the tower is off limits .. no one is to be in the tower .. send a flag out the front door to indicate .. if the phone line is no longer working or if you do not er if you have any intention of trying to contact us this will initiate or help us to initiate telephonic contact with you .. once again this is not an assault we are not entering the building .. do not fire your weapons .. if you are attempting to recontact us by way of telephone er and it is not working .. put a signal of some sort a flag out the front door and-

45.16

[Tape switched Off]

[End of side A]

Side B - 72 - Day 11 - Tape 30

BS An armed stand off is not gonna help anyone we don't anyone else to be injured

[No speech]

6.03

BS Good morning those of you inside the Branch Davidian compound we are in the process of placing tear gas into the building .. this is not an assault we are not entering the building .. this is not an assault do not fire your weapons .. if you fire .. fire will be returned do not shoot this is not an assault .. the gas you smell is a non-lethal tear gas .. this gas will temporarily render the building uninhabitable .. prolonged exposure could be harmful to you and your children exit the compound now .. follow instructions .. you are not to have anyone in the tower .. the tower if off limits .. no one is to be in the tower anyone observed in the tower will be considered to be an act of aggression and will be dealt with accordingly .. if you come out now .. you will not be harmed .. follow all instructions .. come out with your hands up .. carry nothing do not bring any type of weapons or anything that could be considered a weapon out of the (compounds) with you .. come out of the building and walk up the driveway toward Double E Ranch Road .. you will observe a large Red Cross flag at that location come out now and you will not be harmed .. follow all instructions of the FBI agents in the Bradley vehicles .. follow all instructions .. you are under arrest .. this stand off is over .. you are under arrest .. this stand off is over .. we do not want anyone to be hurt .. follow all instructions .. this is not an assault do not fire any weapons .. we do not want anyone to be injured .. gas will continue to be delivered until everyone is out of the building .. exit the compound now .. David Steven .. it is time to submit and surrender to the proper authority .. that time is now .. exit the compound now and no one will be injured .. David Steven .. you need to initiate contact with the negotiators

over the phone .. if that phone is no longer functional .. if the line has been cut .. please indicate so by putting some sort of a signal or flag out the front door .. this is not an assault do not fire your weapons .. if you fire .. you will be fired upon

[Faint ringing sound in background]

[No speech]

11.23

[Background speech]

BS David Steven .. we have observed the flag that you've hoist outside the front door .. you need to indicate to us whether or not the phone is working .. or whether or not you have thrown the phone out of the building .. if in fact the phone is working re-initiate contact with the negotiators now .. if it is not working if it not working you will have to pass that message to us .. with the first people coming out of the complex .. this siege is over .. David Steve it is time for those people to come out they can bring forward the message er .. and we can er attempt to re-initiate contact at that time .. gas will continue to be delivered until everyone is out of the building .. exit the compound now .. if you can retrieve the phone if it was in fact thrown out then re-initiate contact with the negotiators .. if that phone is not operational .. we will attempt to work on getting another phone into you however in the meantime you have got to realise this stand-off is over .. you are under arrest its time for you to comply with instructions and exit the compound

[No speech]

12.55

UM --

BS [Coughs]

UM - ... right now

13.05

BS David Steven if you intend to get back on the phone .. if you intend to get back on the phone retrieve the flag and replace it with a different coloured instrument .. if you intend to get back on the phone retrieve the flag .. currently displayed and replace it with a different coloured instrument .. ensure that it does not resemble a weapon

[No speech]

15.28

BS

BS David Steven those of you remaining inside the Branch Davidian compound ..

it's time to exit that compound in an orderly fashion .. er we have observed the red banner er .. it is the .. opinion of the commanders that we will er continue to attempt to contact or communicate you with you however it is time .. for you to exit the compound in an orderly fashion .. we have received reports that although we have not initiated fire towards you there has been fire initiated towards the (tanks) therefore .. we are not in a position to place our agents in jeopardy to deliver a phone to you at this time

UM - ... come out place a flag out

If you intend to come out at this time place a flag out the front door and we will ensure that you have a safe exit from the compound if you intend to come out at this time .. change the flag at the front door and we will ensure that you are exiting into a safe environment .. we are in the process of delivering tear gas into the building .. this is not an assault we are not entering the building .. this is not an assault do not fire your weapons if you fire fire will be returned .. do not shoot this is not an assault .. the gas which you smell is a non-lethal tear gas .. the gas will temporarily render the building uninhabitable .. exit the compound now and follow instructions .. do not do not have anyone in the tower .. the tower is off limits .. no one is to be in the tower .. anyone observed in the tower will be considered an act of aggression and will be dealt with accordingly .. if you come out now .. you will not be harmed .. follow all instructions .. come out with your hands up .. carrying nothing .. come out with

your hands up in an orderly fashion carrying nothing .. come out of the building and walk up the driveway towards Double E Ranch Road and follow the instructions provided to you .. there will be large Red Cross flag which will be a location where the agents will be waiting to take you into custody .. you will be treated professionally you will not be injured .. follow all instructions of the FBI agents in the er Bradley armoured vehicles .. follow the instructions you are under arrest this standoff is over .. you are under arrest this standoff is over .. we do not want anyone to be hurt .. David you know this .. it's time for you to lead your people out of the compound and lead them out in a safe and orderly fashion .. follow the instructions .. this is not an assault .. do not fire any weapons .. we do not want anyone including David Steve all of you that have er .. we've talked with for so many days we do not want anyone injured .. tear gas will continue to be delivered until everyone is out of the building ... exit the compound now .. exit the compound now .. David Steven .. if you intend to exit .. as you intend to exit .. produce the same white flag .. prior to a uniformed and orderly exit .. do it now

UM - ... tell em to come out (gas)

[No speech]

20.05

BS David Steven I've been advised that if you do not exit within the next two minutes .. additional gas will be inserted into the building .. this is not gonna end David .. until you exit in a peaceful and orderly fashion .. gas will continue to be delivered until everyone is out of the building .. there is not compromise on that position .. you are under arrest and this standoff is over .. exit the building now in an orderly fashion and no one will be injured

[No speech]

[Microphone click]

21.07

[Background noise]

26.58

[Microphone noise & movement noise]

BS David .. Steven

[Microphone noise]

27.16

BS David .. Steven .. since you've not complied with the two-minute warning er we are going to continue to introduce gas .. gas will continuously be delivered until everyone is out of the building .. the gas will continue to be delivered until everyone is out of the building .. exit the compound now .. come out in an orderly fashion no one will be hurt .. you will be treated in a professional manner exit now and no one will be hurt .. since you have not complied with the two minute warning additional gas will be introduced into the building and will continue to be delivered until everyone is out of the compound .. exit the compound now .. David Steven all of you remaining in the Branch Davidian compound you are under arrest this standoff is over .. we do not want anyone to be hurt .. follow all instructions this is not an assault .. do not fire any weapons we do not want anyone to be injured .. gas will continue to be delivered until everyone is out of the compound .. exit the compound now surrender to the proper authority

[No speech]]

32.00

[No speech]

38.08

BS If you fire fire will be returned do not shoot this is not an assault .. the gas you smell is a non-lethal tear gas this gas will temporarily render the building uninhabitable .. exit the compound now and follow instructions .. you are not I repeat not to have anyone in the tower .. the tower is off limits .. no one is to be in the tower .. anyone observed in the tower will be considered to be engaged in an act of aggression and will be dealt with accordingly .. if you

come out now you will not be harmed .. follow all instructions .. come out with your hands up .. carry nothing .. come out of the building and walk up the driveway toward Double E Ranch Road .. walk towards the large Red Cross flag .. follow all instructions of the FBI agents in the Bradley .. you are under arrest this stand off is over .. we do not want anyone to be hurt .. follow all instructions .. this is not an assault .. do not fire I repeat do not fire .. any of your weapons .. we do not want anyone to be hurt .. gas will continue to be delivered until everyone is out of the building exit the compound now .. submit yourself to surrender to the proper authority .. do not subject yourself and your children to any further discomfort .. place the white flag out of the door to indicate your readiness to exit .. this standoff is over it is time to come out now .. it is time to come out now

[No speech]

45.25

[Tape switched Off]

[End of side B Tape 72 Day 11 - Tape 30]

Transcript

Lab ref: 00053/CMM/14

Tape ref: Enhanced copy of 72 Day 11 Tape 31

Key:

.. Natural pause

.... Indecipherable

() Sounds like

[] Descriptive text

- Continuation of speech

0.00 Cassette run time in minutes and seconds

D David Koresh

S Stephen Schneider

BS Byron Sage

UM Unknown male

UF Unknown female

C Child

RBM Radio Broadcast Male

RBF Radio Broadcast Female

00.10

[No speech]

[Background noise]

01.36

BS David .. Steven .. those of you remaining inside the Branch Davidian compound .. we are continuing to introduce tear gas into the building .. this is not an assault .. we are not entering the building .. you are not going to be subjected to any fire unless you fire upon the agents in the proximity of the compound .. do not fire your weapons .. if you fire you will be fired upon .. do not shoot this is not this is not an assault .. the gas you smell is a non-lethal tear gas .. the gas will temporarily render the building uninhabitable .. exit the compound now and follow the instructions .. David Steven .. we have covered the instructions previously I am gonna go over 'em again .. you are free to exit the compound in an orderly manner .. exit the front door after displaying a white flag to ensure that the agents outside are prepared to receive you .. we are prepared to receive you at this time .. exit the compound by coming out the front door and turning to the left .. walk down the driveway towards Double E Ranch Road and you will receive specific instructions .. from the FBI agents in the armoured vehicles .. exit the vehicle or exit the compound at this time and you will be provided immediately with proper medical attention to assist in diminishing and reducing and relieving the discomfort from the gas .. you need to come out of that compound immediately .. gas will continue to be delivered into the compound until everyone has exited .. you are not to have anyone in the tower .. the tower is off limits .. no one is to be in the tower .. anyone observed in the tower will be considered to be an act of aggression and will be dealt with accordingly .. do not have any weapons in the windows .. if you come out no one will be harmed .. when you come out .. no one will be harmed

.. follow all the instructions provided to you .. come out of the compound with your hands up carrying nothing .. come out of the compound with your hands up carrying nothing .. come out of the building and walk up the driveway towards Double E Ranch Road .. David this is exactly as we have discussed previously Stan .. you know it is as well .. you can exit the compound walk up the .. driveway towards Double E Ranch Road .. and you will receive appropriate instructions at that point in time .. along with immediate medical care and transportation .. walk towards the Red Cross flag .. follow the instructions of the FBI agents in the Bradleys .. you are all under arrest .. this standoff is over .. we do not want anyone hurt .. this is not an assault do not fire any weapons .. it's time to end this and end it peaceably .. we do not want anybody injured .. gas will continue to be delivered until the last person is out of the building .. there is no variance there is no compromise gas will continue to be delivered until everyone is out of the building .. exit the compound now there is absolutely no reason to continue to subject yourselves and your children to any more discomfort .. place a white flag out the front door to indicate your readiness to exit with the first group of people .. we are ready .. as soon as you are

[Microphone contact noise]

19.09

BS Branch Davidians we are continuing to place tear gas into the building .. this is not an assault .. we are not entering the building .. do not fire your weapon .. if you fire fire will be returned .. do not shoot .. I repeat do not shoot your weapons this is not an assault .. the gas you smell is non-lethal tear gas .. it will temporarily render the building uninhabitable .. the gas will eventually permeate your food your clothing and your water .. exit the compound now and follow the instructions we have discussed at length throughout this standoff .. you are not to have anyone in the tower .. the tower is off limits .. no one is to be in the tower anyone observed in the tower will be considered .. to

be an aggressor and will be dealt with accordingly .. if you come out now you will not be harmed follow all instructions .. come out with your hands up carry nothing come out of the building and walk up the driveway towards the Double E Ranch Road .. follow instructions of the FBI agents in the Bradleys .. you are under arrest .. this standoff is over .. David Koresh no longer .. directs the compound members .. we do not want anyone to be hurt follow our instruction this is not an assault .. do not fire your weapons .. we do not want anyone to be hurt .. you are responsible for your actions inside that building .. come out now .. we will continue to deliver gas until everyone is out of that building .. it is time to end this matter .. leave the building now .. surrender and you will be treated professionally .. do not subject yourself and your children to any more discomfort .. come out from the building now .. we will continue to deliver gas .. it is time for you to leave the building .. David Koresh will not any longer direct your activities in the building .. leave the building now

[No speech]

31.25

BS We are continuing .. to introduce tear gas into the building this is not an assault .. we are not entering the building at this time .. we are not entering the building at this time .. this is not an assault .. do not fire your weapons .. if you fire .. fire will be returned .. do not shoot this is not an assault .. the gas you smell is a non-lethal tear gas .. the gas will temporarily render the building uninhabitable .. the gas will eventually permeate all of your food .. clothing and water supply .. exit the compound now and follow instructions .. the exit and evacuation plan is the same as that which we have discussed throughout this standoff .. you will come out of the front door in an orderly fashion .. after displaying a white flag indicating your immediate departure .. walk down the driveway .. towards Double E Ranch Road and follow the specific instructions provided to you by the agents in the Bradley vehicles .. there is not to be

anyone in the tower .. the tower is off limits no one is to be in the tower .. any movement observed in the tower will be considered an act of aggression and will be dealt with accordingly .. you are responsible for your own actions .. if you come out now you will not be harmed .. follow all instructions provided to you .. when you come out .. come out with your hands held high carrying nothing .. come out of the building and walk up the driveway towards Double E Ranch Road .. and medical attention will be provided to relieve your discomfort .. walk towards the large .. white .. Red Cross flag .. follow all instructions the FBI agents in the Bradleys provide to you .. you are under arrest this standoff is over .. David .. you are under arrest this standoff is over .. come out and you will be treated professionally .. your needs will be addressed as we have promised you in the past .. the time to delay is over .. we don't want anyone else hurt .. follow the instructions provided and we can end this matter without any further injuries this is not an assault .. do not fire any weapons .. we do not want anyone to be hurt .. submit to the proper authorities .. gas will continue to be delivered until everyone is out of the building ... David .. Steve .. Wayne all of you need to realise that this is not going to end until all of you are out of that building .. gas will continue to be delivered in an increasing volume .. until everyone exits the building .. exit the buildings now .. do not submit yourself and subject your children to any more discomfort .. delay is futile .. place a white flag outside of the front door to indicate your readiness to exit .. we are ready to meet you and to provide you with the appropriate medical attention .. to relieve you of your discomforts as red' result of this tear gas .. please the time is now come out of the building lets get this over with

[No speech]

35.40

BD - building .. this is not an assault .. we are not entering the building at this time .. this is not an assault .. do not fire your weapons .. if you fire fire will be

returned .. do not shoot .. this is not an assault .. the gas you smell is non-lethal tear gas .. this gas will temporarily render the building uninhabitable .. gas will eventually permeate your water .. your clothing and your food supplies exit the compound now .. follow the instructions we've discussed at length throughout this standoff .. you are not to have anyone in the tower .. the tower is off limits .. I repeat the tower is off limits .. any movement observed in the tower will be considered an act of aggression and will be dealt with accordingly .. you are responsible for your own actions .. if you come out now you will not be harmed .. follow all the instructions .. come out with your hands up carry nothing .. come out of the building and walk up the driveway toward the Double E Ranch Road and medical attention will be provided to relieve your discomfort .. follow the instructions of the FBI agents in the Bradleys .. you are now under arrest .. this standoff is over .. come out and you will be treated professionally we do not want anyone to be hurt .. this is not an assault .. I repeat it is not an assault do not fire your weapons .. we do not want anyone to be hurt .. we will continue to deliver gas until everyone is out of the building .. exit the compound now .. surrender to the FBI agents .. do not subject yourselves and your children to any further discomfort .. do not subject yourself and your children to any further discal' .. er discomfort .. place the white flag out of the door to indicate your readiness to exit .. let's finish this now .. come out of the building

[No speech]

38.19

BS Those of you remaining inside the Branch Davidian compound .. we are continuing .. in efforts to .. convince you that it's time to depart from that building .. these efforts are not meant to injure anyone inside .. we will continue to introduce tear gas into the building .. in an effort to er direct you out of the building .. this is not an assault .. you are not .. to come out of the building with any type of weapon .. or anything that would appear to be a

firearm .. we do not intend to enter your building at this time .. this is not an assault .. do not fire your weapons do not appear at the windows with anything that could be construed as being a weapon .. if you fire .. your fire will be returned .. do not shoot this is not an assault .. the gas you smell and will continue to detect is a non-lethal tear gas .. this gas will temporarily render the building uninhabitable .. and by temporary I mean as long as it takes to get each and every one of you peacefully outside of that building .. the tear gas will continue to be introduced and will eventually permeate and contaminate your water supply .. permeate your clothing and ruin your food .. exit the compound now and avoid any further discomfort .. exit the compound and comply with the exit and evacuation plans that we have been discussing for weeks .. the plan will be the same as previously discussed .. including the .. peaceful and orderly exit from the compound by way of the front door .. turn immediately to the left and proceed down the sidewalk or down the er driveway .. towards the Double E Ranch Road .. do not under any circumstances have anyone in the tower .. the tower is off limits .. no one is to be in the tower .. movement observed in the tower will be considered an act of aggression and will be dealt with accordingly .. you are responsible for your own actions .. if you come out now you will be treated professionally and no one will be harmed .. follow the instructions provided to you by the FBI agents immediately upon your exit .. come out with your hands up .. carrying nothing .. do not have anything in your hands or on your person which could be .. construed as a possible weapon .. come out of the building and walk up the driveway towards Double E Ranch Road .. and medical attention is standing by to provide you with relief for your discomfort .. follow all instructions of the FBI agents in the Bradleys .. follow all instructions as they are provided to you properly and thoroughly .. you are under arrest .. this stand off is over .. this matter will be resolved .. and will be resolved as swiftly and professionally as possible .. we are not here to inflict any injury on any individuals .. come

out now in an orderly fashion and no one need be injured .. you are all under arrest .. this standoff is over .. come out and you will be treated professionally .. this is not an assault .. do not fire any weapons .. we have no intention of entering your compound at this time .. this is not an assault do not fire any weapons on any of the vehicles or individuals outside of your compound .. we do not want anyone else hurt .. submit David to the proper authority and submit now .. gas will continue to be delivered until everyone is out of the building .. this is not a negotiable position gas will continue to be delivered until everyone is out of the building .. this action has been brought about by your inaction .. and we intend to follow through with this course of action until everyone is safely removed from the building .. exit the compound now .. do not subject yourself and your children to any more discomfort .. place a white flag outside of the door to indicate your readiness to exit .. the sooner you do this the sooner you'll be able to receive relief .. from any discomfort which you maybe feeling from the gas .. if you're not feeling it now .. I guarantee you you will be

[No speech]

43.56

once again this is not an assault .. we are not entering your compound at this time .. this is not an assault .. do not fire on the vehicles or agents around your compound .. if you fire fire will be returned .. do not shoot this is not an assault .. what you smell is non-lethal tear gas .. the gas will temporarily render the building uninhabitable .. we have received your message on the banner indicating that you want to have the phones repaired at this time the proper resolution to this matter is a safe and orderly exit .. we've spoken .. for fifty days .. it's time now for you to exit the building .. and we will treat you in a professional and humane fashion .. due to hostile fire being received by the tanks .. earlier today .. we are not in a position to expose agents to hostile fire

to replace the phone service to your compound .. you are d' you are requested to exit the compound at this time in an orderly fashion .. we are continuing to deliver gas .. once again this is not an assault .. this is not an assault

[No speech]

authorised to send one person out unarmed .. to attempt to recover the telephone which you discarded earlier this morning .. you are authorised to send one person outside unarmed .. to recover the telephone device which you had discarded earlier this morning .. be advised the sole purpose .. for recovering this telephonic device will be to co-ordinate the safe and orderly exit of all occupants of the compound .. with that understanding .. you are authorised to send one person out .. unarmed .. to recover the telephone device which you had sent and or discarded previously this morning .. the understanding being that the purpose for re-estab-

[End of side A]

Side B Tape 73 Day 11 - Tape 31

00.14

BS Be advised that erm .. we received your message that the phone line appears to be cut .. we want you to retrieve as much of the er cord and the device back into the building as you can to see if it's repairable .. let us know if it appears to be repairable .. give us a signal .. if it is not .. er .. they're exploring avenues as to whether or not we have another phone which we can provide to you .. once again I stress to you that the only purpose for re-establishing that contact is going to be the co-ordination of a rapid and orderly extraction of all people from inside the compound .. we would ask you to retrieve the wire and instrument back into the compound .. have Graham or whoever er review it to see if it's repairable and give us some sort of a message .. the primary message that we're delivering to you .. is it is time to exit the compound and exit now .. we will once again assure you .. that you will be treated professionally and that appropriate medical care and transportation is waiting for you at this time .. go ahead and retrieve the device er .. telephone device and the cord and advise us as to whether or not you can er make the device work

[No speech]

02.40

[Background speech]

02.45

BS David

[No speech]

BS Hello

[No speech]

BS Steven .. David .. er .. go ahead and er bring the wire back into the compound area .. er we're still checking to see if er that device does not work er .. we'll try to get you another telephone device to hook up to it .. er .. go ahead and

recover as much of the telephone line as you can back into the compound .. and we will attempt to see if there's another er field phone device to er .. er get to you .. once again I repeat to you .. it's a purpose for re-establishing communication if possible .. will only be to co-ordinate the rapid response and exit of individuals from inside the compound er so go ahead and recover as much of the telephone line as you can at this time back into the compound

[No speech]

04.20

BS We're going to continue to introduce tear gas into the building .. once again this is not an assault .. we are not entering the building at this time .. do not fire your weapons if you fire .. fire will be returned .. do not shoot this is not an assault .. the gas you smell is a non-lethal tear gas .. the gas will temporarily render the building uninhabitable .. eventually the tear gas will work its way into your water into your clothing and your food .. exit the compound now .. the time for talk is finished .. exit the compound .. the exit evacuation plan will be the same as we have discussed throughout this standoff .. you are not to have anyone in the tower .. the tower is off limits .. no one is to be in the tower .. movement observed in the tower will be considered an act of aggression and will be dealt with accordingly .. you and only you are responsible for your own action .. if you come out now you will not be harmed .. follow all instructions come out with your hands up and carry nothing .. come out of the building and walk up the driveway towards Double E Ranch Road .. medical attention will be provided to relieve any discomfort .. follow the instructions of FBI agents in the Bradley vehicles .. this standoff is over it is time to move on .. you can continue the at another location at another time .. come out and you will be treated professionally .. we do not want anyone to be hurt .. this is not an assault .. gas will continue to be delivered until everyone is out of that building .. the time to finish this is now .. we do not .. that is we do not want you to stay in that building .. the time to exit is now

[No speech]

07.05

[Pause action]

BS Good morning .. this is er Byron Sage .. we are continuing to place tear gas into the building and will continue until the last person is removed .. hopefully safely and unharmed .. this is not an assault .. we have no intention of entering your building at this time .. this is not an assault so do not fire any of your weapons .. if you fire you will .. the fire will be returned .. do not shoot this is not an assault .. the gas that you have been exposed to .. and will continue to be exposed to is a non-lethal tear gas .. this gas will temporarily render the building uninhabitable .. it will also eventually permeate your water .. food and clothing .. you need to realise that this stand off is over it is now time to exit the compound in an orderly fashion .. David Steven .. we have discussed on numerous occasions the exact and safe evacuation plan .. that same plan is in effect now .. you will exit the compound by coming out the front of the building .. turning immediately to the left .. and proceeding down the driveway towards Double E Ranch Road .. the medical facilities are already staged and ready to assist you upon your exit .. the transportation is already here and ready to .. forward you on for appropriate processing and to expedite your appearance before the magistrate .. the time is now David it's time to come out of the compound .. you've stressed the fact that you .. have concern for your followers you've stressed the fact .. that you are still working on the seven seals .. demonstrate your concern for your followers .. we will demonstrate our ability in allowing you to continue to work on the seven seals following your release .. the .. instructions remain intact regarding the tower .. the tower is off limits .. no one it to enter the tower .. any movement in the tower will be considered an act of aggression .. and will be dealt with accordingly .. David .. Steven .. Wayne all of you remaining inside the compound you are responsible for your own actions .. it's time to exercise that responsibility and lead those

people out of the compound safely and securely at this time .. if you come out now you will not be harmed .. follow all of the instructions as they are provided to you by the FBI agents .. come out of the complex with your hands up .. carry nothing with you .. have nothing on your person which will appear to be a weapon .. come out of the building and walk up the driveway toward Double E Ranch Road and medical attention will be provided to relieve you of your discomfort from the gas .. follow the instructions specifically as they're provided to you by FBI agents which will meet you in the Bradleys .. follow these instructions and we will not have any further difficulty with relation to a safe resolution of this matter .. this stand off David is over .. the delay is over it is time to move forward and get this matter resolved .. we've been here for over fifty days .. we will not be here any longer .. come out and you will be treated professionally .. I personally assure you of this .. we do not want anyone to be hurt .. follow these instructions and there will be no further injuries and no further .. need to expose yourself and the children to any more discomfort .. this is not an assault .. it has not been assault .. do not fire any weapons in relation to on-going activities .. we do not want anyone to be hurt .. it is time David to submit to the proper authorities .. gas will continue to be delivered .. until each and every one of you are out of the building .. this is not a negotiable area .. gas will continue to be delivered until each and every one of you has exited the building .. exit the compound now .. we stand ready to receive you provide you with the medical care that you need .. provide you with the transportation and the legal representation .. I am sure you are listening to the radio this is getting a significant amount of attention .. your concerns regarding getting your message out at media attention er .. we do not stand in the way of facilitating that for you we've told you that for fifty days ... it's time to come out its time to come out now .. place a white flag out of either side of the front door to indicate your readiness to exit lets get this moving lets get it moving now

[No speech]

13.00

[Pause action]

BS We are continuing to place tear gas into the building this is not an assault ... we are not entering the building do not fire your weapons .. if you fire fire will be returned .. do not shoot this is not an assault .. the gas you smell is a nonlethal tear gas .. it however will temporarily render the building uninhabitable .. it will eventually permeate your water .. your clothing and your food .. exit the compound now .. lets get this resolved .. the exit plan is the same plan we have discussed at length throughout the last forty-nine days .. once again you are not to have anyone in the tower .. the tower is off limits .. there's to be no one in that tower any movement observed in the tower will be considered an act of aggression .. and will be dealt with accordingly .. you and only you are responsible for your own actions .. come out now you will not be harmed ... follow the instructions .. that we are to give you .. that is come out with your hands up .. carry nothing .. come out of the building and walk up the driveway towards Double E Ranch Road .. medical attention is standing by to provide you with the necessary care to relieve you of your discomfort .. follow the instructions of the FBI agents in the Bradleys .. this stand off is over .. we have been here fifty days .. it is time for you to exit the building .. there is nothing to be gained by staying in that building .. come out now and you will be treated professionally .. none of us want to see anyone hurt .. follow all the instructions .. that is leave the compound walk up to the Double E Road .. where we will be met by FBI agents .. this is not an assault .. you need to take care that you do not fire your weapons .. you must submit to the proper authority now .. we will continue to deliver gas until everyone is out of that building .. do not subject yourself and your children to any more discomfort .. David it is time for you and Steven and the rest of the folks out there to leave

the building .. it is time for this to be resolved safely and that is what we're here to do

[No speech]

16.03

[Pause action]

BS We're still here and so are you .. we need to er get this thing moving forward .. it's our intention that we are not leaving .. until all of you are safely removed from that compound .. er we will continue to place tear into the building .. as necessary .. to bring you out .. the only thing you're doing by delaying is postponing the inevitable .. this is not an assault it never has been .. what we're attempting to do is introduce a non-lethal gas .. to extract you from inside of the er compound .. we're not entering the building .. but we will continue to press this issue to ensure that each and every one of you will eventually be forced to exit the compound .. do not fire you weapons .. we have er confirmed reports that several rounds having been fired at our agents .. we have not ref' returned fire to you .. but if we deem that our agents are in jeopardy you will be fired upon .. do not shoot .. this is not an assault .. the gas will smell and will be quite obvious to you .. it is a non-lethal tear tear gas .. this gas is nonlethal and will temporarily render the building uninhabitable .. it will eventually fully permeate your water and food supply .. it will be extremely discomforting as far as exposure to your skin .. and it will not improve until such time as you get proper medical care .. we stand ready to provide that medical care to you .. you need to exit the compound at this time and follow the instructions that have been provided to you .. by exiting the compound you'll exit the front of the building .. turn to your left and proceed down the driveway towards Double E Ranch Road .. full medical attention will be provided to you immediately upon reaching this area .. we have medical capability standing by .. and we're ready to furnish those to you as we have promised throughout the last fifty days .. once again there is to be no one in the

tower .. the tower is off limits there is to be no one at the windows with firearms .. any movement observed in the tower will be considered an act of aggression and will be dealt with accordingly .. David each and every one of you need to realise that you're personally responsible for your own actions ... that's been true from the very first day .. it is true today .. come out now and no one will be harmed .. come out with your hands up carrying nothing .. don't have anything on your person which would appear to be a firearm .. explosive or any other er .. possible hazardous device .. come out of the building and walk up the driveway toward Double E Ranch Road .. medical attention is waiting for you at this time .. follow the instructions provided to you specifically by the FBI agents in the Bradley vehicles .. this standoff David is over .. we intend to resolve this matter .. hopefully as peaceably as possible .. but that is going to be due in large part to your response .. so far your promises have been false .. your word has been hollow .. it's time to live up to the position which you claim to hold within that compound .. you have mentioned David that the individuals inside that compound are free to leave at any time ... the time is now .. we don't want anyone injured .. we want you to exit now and submit yourself to the proper authorities .. gas will continue to be applied .. gas will continue to be delivered .. until each and every person is out of the compound .. do not David .. please .. do not continue to expose those children to any more discomfort .. that decision is yours and solely yours .. you claim to be the leader .. you claim to be the Prophet you claim to be the Messiah .. the time is to lead your people out now

[No speech]

20.55

[Pause action]

BS David .. it's Byron Sage again .. we are continuing as you can observe .. to apply the non-lethal tear gas .. to the building this is not an assault never has been .. we are not entering your building .. the continued property damage is

directly within your control .. if you want to come out at this time .. without any further damage to the .. er facilities that is perfectly within your .. capability of doing .. all you need do is to display the white flag indicating your .. er readiness to exit and we will make appropriate arrangements .. do not fire on the vehicles or agents which are in the immediate proximity of the compound .. if in fact you do fire .. and the agents lives are perceived to be in jeopardy you will be fired upon .. do not shoot this is not an assault .. the gas which is being administered as we speak is non-lethal tear gas .. the gas will temporarily render the building inhab' uninhabitable and will render the occupants in severe discomfort .. the gas will also eventually permeate the water supply food supply .. clothing etcetera .. believe me it will not get any better it will only get worse .. the time to exit the compound is now .. please just follow the instructions that we've laid out to you previously .. including the exit or evacuation plan which has been the same since we discussed it throughout this stand off starting on the 2nd of March .. you'll be called upon to exit the compound .. in an orderly fashion .. turn left proceed down the driveway towards the Double E Ranch Road and you will see armoured vehicles parked at that location .. displaying a large Red Cross flag .. appropriate medical attention will be provided to relieve you of any discomfort as a result of the gas .. additional medical coverage is available as we previously discussed .. for those of you who have been injured including David .. Judie .. er .. David Jones .. er Scott (Sinobi) and so forth .. what we need to do is get this over with so that you no longer have to .. er live in the conditions which you're currently facing with relation to severe discomfort and or serious bodily injury .. we do not want anyone hurt .. come out now and no one need be harmed .. follow the instructions .. come out with your hands up .. carrying nothing .. do not have anything in your hands .. or anything on your body .. which might be construed as a weapon .. the .. warning regarding the tower remains in effect .. the tower is off limits .. no one is to be in the tower .. any

movement observed in the tower will be considered an act of aggression .. and will be dealt with accordingly .. follow the instructions as it will be set forth to you by the FBI agents in the Bradley vehicles .. this stand off David is over .. it's time for you to realise it .. it's time to get this resolved get this matter into the court system .. you have all assurances which have been relayed to you by the negotiators over the last fifty plus days .. you also have the assurances provided directly to you by legal council .. you know that you can rely on those .. you know that you can rely on the promises that have been made to you as far as medical treatment and proper handling .. don't subject your people to this discomfort any longer .. come out and you will be treated professionally .. do not do not .. initiate any type of hostile action against the vehicles or the agents in the immediate vicinity of the compound .. it is time David to submit to the proper authority .. gas will continue to be delivered .. will continue to be delivered into the compound until everyone is out of the building safely .. exit the compound now .. this entire operation which should not have .. needed to have been put into effect had you lived up to your promises has been orchestrated to prevent any further injury .. we will continue to apply pressure until you come out .. you know this is true David .. don't put your people through any more of this .. submit to the proper authority now .. do not subject yourselves your children to any more discomfort .. David you have said .. that those inside are free to leave at any time .. it's time for you to live up to that word .. in fact not only to send them out .. but to lead them out .. if you in fact are their leader as you profess .. lead your people out now .. place a white flag out of the front door area to indicate your readiness to exit and we will work with you to get this thing resolved .. David it's in your ball park .. the timing is on you .. within reason cos we are not going away .. it's time to resolve this now lets get it done

[No speech]

26.57

[OFF/ON action]

UM and er

BS David er it's time for this to be over .. we think er .. we're in position to er administer more gas .. you know exactly where we are .. we know exactly where you are .. it's time for you to .. give this up come out peacefully without anyone else being er injured er and we need to go ahead and and get this revolved now .. the decision is yours the time is to go ahead and come out and surrender .. display that flag out the front door and lets get an orderly resolution to this matter right now .. we don't want to inflict any injuries of anyone .. there's no reason to prolong this agony .. we are prepared to stay here as long as it takes to force you all out of there .. this is not doing you any good it's not doing er anyone any good and we don't .. do not want to promote any further injuries .. we are prepared to distribute a significant increase in the amount of tear gas into your building right now .. we do not want to have to do that .. the decision is yours .. come forward and show a sign right now in the form of a flag out the front door or an individual waving his arms and we will not administer the gas .. but if you do not respond at this time .. the gas will be distributed and you will have the effect full face .. do not fire any weapons do not take any hostile action against the vehicles or the agents who were administering this gas .. the gas will smell .. that you smell is a non-lethal tear gas .. if you do not want it to continue to be distributed within those facilities now is the time for you to act .. I am asking for you David right now to take action on behalf of your people .. display the flag outside and we will advise the people in the armoured vehicles to stand back and allow a peaceful and orderly exit .. but your opportunity is at hand David right now .. it is time for you to move forward .. on behalf of your people and put an end to this situation .. peacefully .. we're prepared to do that we're prepared to back off .. and facilitate your safe and orderly exit .. we're prep' prepared to do it right now it's time for you to do it .. you know the results of this gas if it is in fact

administered will render your building uninhabitable for a period of time .. the more gas that's in' that's put into the building the longer it's gonna take to get it out .. so David the decision is yours .. it's time to turn that gas off you have the capability of doing it by waving a white flag out the front to indicate to us that you're ready to begin an orderly progression or exit from the Mount Carmel complex .. no harm no harm need come to anyone else inside that building .. and no harm will come once you exit the building .. you will be properly treated professionally treated .. and all of the provisions which have been er made known to you will be upheld .. this stand off is over David it is time to bring it to an end .. submit yourself to the proper the proper authority and it stands before you as we speak .. this matter had been carefully orchestrated to prevent any further injury .. we will continue to apply pressure you have the capability right now right now .. of calling an end to it .. do not subject yourself or your children to any more discomfort .. you have some precious young kids in there .. we do not .. we do not intend to nor do we want to inflict any injury on those kids .. the same applies to you and your followers please .. David it is time to bring this to an end .. come out lead your people out .. in an orderly fashion .. and we will get this handled right now

[Person cough's in background]

[No speech]

31.55

{OFF/ON action]

BS See we're trying to facilitate your leaving the compound by enlarging the doors somewhat for you .. we are continuing to place tear gas into the building .. this is not an assault .. we are not entering the building .. do not fire your weapons if you fire fire will be returned .. do not shoot this is not an assault .. the gas you smell is a non-lethal tear gas .. David you have had your fifteen minutes of fame it's time to leave the building .. the gas will temporarily render the building uninhabitable .. the gas will eventually permeate your

water your clothing and your food causing continuing discomfort .. exit the compound now .. exit the compound now .. the exit or evacuation plan will be the same as we have discussed throughout these fifty days .. ensure that you do not have anyone in that tower .. the tower is off limits .. there is to be no one in the tower .. any movement observed in the tower will be considered an act of aggression and will be dealt with accordingly .. you and only you people out there are responsible for what is happening to that building .. leave the building and we will withdraw from that area .. leave the building now ... follow all of our instructions .. come out with your hands up carry nothing .. walk out the door take a left continue through the driveway area to the Double E Ranch Road medical attention is standing by and will be provided to you to relieve any discomfort you might have encountered as a result of the gas .. listen to the instructions of the FBI agents in the Bradley .. this standoff is over .. we have spent entirely too much time here we have given you .. time and time again opportunity to .. to leave that building we have also given you opportunity to negotiate with us which you have not done .. we have offered in good faith .. a number of alternatives .. you have elected not to select any of those alternatives .. you continue to lie you continue to delay .. it is unacceptable .. follow all or our instructions .. we do not want anyone to be hurt .. it is time for you to submit to the proper authority and go on with your live .. David is no longer in control of the compound the FBI is controlling that compound .. we will continue to deliver gas until you leave that building .. this has been done carefully .. so as not to injure anyone in the compound we will continue to apply pressure .. we will continue to put gas into that building .. we are not going away .. this is a non-stop effort until you leave the building .. there is no longer a reason to remain inside that building .. David you and Steve lead those people from that building .. you are the one who put those people in that position .. it is time for you to bring those people out of there ... Steven you've indicated to us over and over and over again that you're willing

and able and ready to leave that building .. now is the time to do it .. do not depend on David Koresh's ability to make decisions .. it's very clear I think that he is unable to make decisions .. Vernon is finished he's no longer the Messiah .. he is to leave the building now .. exit the building now

[No speech]

36.38

{Pause action]

BS Stop .. raise your hands carry nothing from the building exit the building now .. we are standing by to receive you .. we have medical aid available .. no one will be hurt .. leave your weapons behind .. exit the building now

[No speech]

37.05

BS Bring your children and leave the building

[No speech]

BS Fire is plainly visible .. we observe people lighting the fire .. leave the building .. leave your weapons behind walk from the building you will not be harmed .. leave your weapons behind

UM It is

BS That building is going to be engulfed in fire very shortly .. leave the building now .. take your children and leave the building .. put your hands up and leave the building

37.50

[Background speech]

37.55

BS Leave the building and walk towards the Red Cross sign .. leave the building now .. you will not be harmed will not be fired on .. put your weapons down and leave the building

[No speech]

38.35

{Pause action]

BS Er don't do this to the people that are remaining inside there .. come out of the compound at this time .. er .. come out in an orderly fashion towards the front of the building .. walk down the sidewalk er the driveway area towards the large Red Cross .. er flag .. towards Double E Ranch Road .. we can work through this don't lose control of this David .. don't lose control of this .. bring those people out safely .. they have depended upon you .. this is not the way to treat those people bring em out safely .. we will receive them no one will be injured .. start your orderly progression out of there as soon as possible .. exit .. exit the er compound as soon as you can .. move in a progressive manner .. towards the Double E Ranch Road area .. exit the ... or exit the compound as soon as you can .. the agents remaining in front will provide you with appropriate instruction .. and we will provide er the necessary .. we will provide you with the necessary medical care which you will need .. don't wait too long that smoke will not allow you to exit an orderly fashion and you will be consumed .. exit the vehicle .. exit the location .. precede out the front of the building .. follow directions .. walk towards Double E Ranch Road .. don't wait .. it's obvious that this has been torched from several locations and has been pre-planned David don't do this to your people .. David don't do this to your people .. bring them out in an orderly fashion if you have a message to send David you need to be sending it this is not the way to end this .. come out of the vehicle .. or out of the location in an orderly fashion .. lead your people out David .. be a Messiah not a destroyer

[No speech]

41.05

BS Bring your people out in an orderly fashion David don't lead them to destruction .. bring them out help them to safety bring yourself out .. if you are in fact innocent David as you are proclaimed don't be fearful .. of facing the

judicial system .. we have medical attention standing by but we need you to come out and save your people

[No speech]

41.40

BS David come out .. bring your people out .. do not allow them to .. be injured in this manner .. exit the location in an orderly fashion and we will accommodate your needs .. David bring these people out into the fresh air now .. don't do this to your people .. David there is significant wind out here you don't want to wait too long you need to exit that building and exit now .. exit that building and exit now

[No speech]

43.10

BS The time to come out is now if you can't see your way through walk towards the voice .. walk towards the noise of the speakers .. lead your people out of there .. you have got to come out .. as soon as you possibly can .. come out David as soon as you can walk towards the voice .. bring your people out .. David don't do this to your people .. don't do this to your followers .. bring them out and walk towards the Double E Ranch Road .. come out in an orderly fashion .. the agents will give you specific instructions how to proceed .. this has not been assault against you .. we have not attempted to enter the building you have destroyed this building on your own .. what you need to do now is ensure that your people exit the compound and follow the instructions the same exit evacuation plans .. which we've had in place and discussed throughout this standoff .. you're responsible for your own actions David .. the lives of those people are in your hands .. we have given you every opportunity to exit that compound you need to comply .. come out of that compound David .. you will not be harmed if you come out of the compound .. with your hands up .. carrying nothing we have medical provisions available .. but you need to exit that compound immediately .. walk towards the sound of the speakers .. if

you cannot see .. come towards the speaker bank .. that you can hear broadcasting if you cannot see .. follow all instructions .. this standoff is over you need to come out and be treated .. medically you will be treated professionally .. exit the building and come towards the front of the building towards the reservoir towards Double E Ranch Road

[No speech]

45.44

BS Come out of the .. compound and walk towards Double E Ranch Road .. this has been carefully orchestrated to prevent injury

[No speech]

BS David you've said repeatedly that those inside are free to leave at any time .. the time to come out has passed .. come out .. listen to the instructions of the FBI agents .. if you cannot see walk towards the-

Tape switched Off

[End of Tape 73 Day 11 Tape 31]

Transcript

Lab ref: 00053/CMM/15

Tape ref: Enhanced copy of 72 Day 11 Tape 32

Key:

.. Natural pause

.... Indecipherable

() Sounds like

[] Descriptive text

- Continuation of speech

0.00 Cassette run time in minutes and seconds

D David Koresh

S Stephen Schneider

BS Byron Sage

UBS Unknown male

UF Unknown female

C Child

RBM Radio Broadcast Male

RBF Radio Broadcast Female

01.20

BS Jump from the building roof now

[No speech]

01.43

BS You people on the roof .. that second storey jump from that window .. we will pick you up jump from the building

[No speech]

02.00

BS In order to save yourself you must jump from the roof

[Background speech]

02.23

BS Those of you remaining inside the compound .. er attempt to exit by any means possible .. make your way towards the front of the compound .. and walk towards the Red Cross er flag .. the agents will give you immediate care .. er and direction to medical care .. continue in your efforts to exit from the building if at all possible .. walk towards the voice .. er and the speaker bank .. which is towards the front of the building exit in any fashion that you possible can er .. respond to the instructions of the agents .. come out through any exit that you can .. get to a position of safety and the agents will attend to you ... exit the compound as rapidly as you can .. keep your hands in the air .. keep your hands in the air .. the agents will contact you and bring you to a position of safety .. keep your hands in the air .. exit the compound and keep your hands in the air .. listen to the instructions of the agents .. anyone remaining in the compound .. exit to a position of safety as soon as possible .. leave your hands in the air and surrender to the agents will give you appropriate instructions

[No speech]

04.10

BS Continue in your efforts to exit from the compound .. walk to a position of safety .. leave your hands in the air .. and the agents will respond to you .. exit the building as soon as you possibly can .. walk to a position of safety .. leave your hands in the air .. and listen to the responses of the agents

[No speech]

05.07

BS Exit the compound as soon as you can proceed to a position of safety .. leave your hands in the air and the agents will respond to you with appropriate instructions .. continue to exit the compound as soon as you can .. exit the compound as soon as you can .. proceed to a position of safety away from the fire .. raise your hands and the agents will come to you ... and provide appropriate treatment

[No speech]

05.50

BS Exit the compound .. exit the compound to a position of safety .. come out .. keep your hands in the air and the agents will respond

Tape switched Off

[End of tape 73 Day 11 Tape 32]

Transcript

Lab ref: 00053/CMM/9

Tape ref: Enhanced copy of 73 Day 2 Tape 2

Key:

.. Natural pause

.... Indecipherable

() Sounds like

[] Descriptive text

- Continuation of speech

0.00 Cassette run time in minutes and seconds

D David Koresh

S Stephen Schneider

BS Byron Sage

UM Unknown male

UF Unknown female

C Child

RBM Radio Broadcast male

RBF Radio Broadcast female

0.00 0.07 [Recording begins] [No speech] [Movement noises] 0.33 [Music begins to play] 0.37 UM Hey hello [Music] 0.41 UM Is it there [Music] [Movement noises whilst music being played] 1.04 [No speech - unspecified sound] 1.57 [Music stops - different noise level] 2.43 [Music back on - different noise level] 3.20 [Music] 3.24 [Background voices] 3.30 UM ... I don't know .. off and on and then UM Yeah well UM We can come back to that [Background speech - unspecified sound]

6.06 [Music] [Movement noises] 6.32 [Noise level changes] [No speech - unspecified noise] 7.17 [No speech - unspecified sound] 7.21 [Noise level changes] 8.20 [Movement noises] [Unspecified noise] 9.02 [Noise level changes] 10.24 [Noise level changes] [No speech - unspecified sound] [Movement noise] 10.58 [Audible tone] You have to be ready to face that UM [Audible tone] [Unspecified sound & Audible tone] 11.30 [Movement noise] [Audible tone] 11.46 [Audible tone stops - Noise level changes]

[No speech - unspecified sound] 12.48 [Movement noise] [No speech - unspecified sound] 14.24 [Phone ringing] [Movement noise] 14.30 [Phone ringing] 14.37 [Phone ringing] [Movement noise] 14.42 [Phone ringing] 14.48 [Phone ringing] 14.51 UM Right 14.55 [Phone ringing] 15.02 [Phone ringing] [Movement noises] UM I need to get this to (David) 15.07 [Phone ringing] [Movement noise] .. the phone UM UM Shall we answer it

15.13 [Phone ringing] 15.19 [Phone ringing] 15.24 UM Hello .. hello UM Hello is Steven there 15.30 UM I can't hardly hear you UM Then call me back UM Er no he's .. he's asleep right now UM Well you need to wake him up .. this is Byron Sage .. this is an important call UM Er well sir he asked not to be bothered now .. because you realise today has not been a happy day today but UM I understand but you need to get him up UM I'm gonna go check if he's awake .. hold on [Telephone handset put down] 16.12 [Movement noise and footsteps] UM What am I gonna tell him .. he's just gonna say .. wake him up right now [Movement noise] 16.27 UM We're not going to disturb him [Movement noise] 17.25 UM Hello UM UF You got (him) down now BS Hello

UM Right here .. I can hardly hear ya

BS Can you hear me now

UM But very weakly

BS Okay .. this is Byron Sage .. I need to advise you of something very

important .. understand

UM I can hear ya

BS Okay .. we're in the process of putting tear gas into the building

UM Ok

BS This not an assault .. we're not entering the building .. it is not an assault

18.28

UM You are going to spray tear gas into the building

BS We will not stop ...

UM Tear gas .. we're ready for

BS Do not fire any weapons .. if you fire .. fire will be returned

18.43

UM Everybody grab your masks .. everybody grab your masks

UM I didn't want this

[Movement noise]

[Background noise & vehicle noise]

BS Soon as we enter the Branch Davidian compound .. we are now in the

process of placing tear gas into the building .. this is not an assault .. this is

not an assault .. we will not be entering the building .. this is not an assault ..

do not under any circumstances discharge your weapons .. if you fire .. fire

will be returned .. do not shoot .. this is not an assault

UM They'll (grind us) all up

BS We will not .. we will not leave the tanks

19.33

UM Stay back everybody

BS The gas will temporarily render the building uninhabitable

UM Where we supposed to go

[Vehicle noise]

UM We should go (outside) ...

BS Exit the compound now and follow instructions that

[Vehicle noise]

19.44

BS You are not to have anyone in the tower .. the tower is off .. the tower is off limits

UM They'll be shooting that

UM Everybody wake up .. they're starting to spray us

UM Where are they gonna shoot

BS Come out now .. do not fire any .. lower all weapons .. come out of the compound .. do not carry any weapons .. come out of the building and walk up the driveway .. towards the Double E ranch road

20.03

UM David .. should have realised they

BS - just walk towards the large Red Cross flag towards the road .. follow all instructions by the FBI agents in the Bradley's

20.51

[Unspecified sound]

BS Follow all instructions .. you are under arrest .. this stand-off is over .. we do not want anyone hurt

21.07

UM Where's Steve

BS Follow all instructions

UM He's down here

UM Just wait til we

BS This is not an assault

UM What

BS Do not fire any weapons

UM We need to wake up everybody

BS We do not want anyone hurt

UM This time we've been told

BS - please as you exit put your weapons down .. we are not going to have an

assault

21.23

UM Ready to go

UM Yeah

BS Those who choose to remain inside the Branch Davidian complex ..

surrender to the proper authorities

UM

21.36

BS We do not anyone .. follow all instructions .. this is not an assault

UM Whatever you got on

BS Do not discharge any weapons .. we do not want anyone hurt .. the gas will

continue to be delivered until every one is out of the compound

UM I'm sorry .. this is really bad

BS Exit the compound now .. you should now leave the tower .. you are advised

there is to be no one in the tower

UM Have you got those ready

BS The tower is off limits .. at this time the tower is off limits .. you are warned

22.16

UM We can go out side

BS No one should be in the tower .. anyone comes round on the tower on being

observed will be seen as an act of aggression and will be dealt with

accordingly

[Movement noise]

UM Are ya ready in here

UM Why don't you get ready

UM do

[Vehicle noise]

BS We're not coming in .. this is not an assault

UM ... on top of that wall

BS - not an assault

UM You want them

[Sharp bang - movement sounds]

UM Ohh

BS The tower is off limits

22.58

UM Too late for that

UM And anyway now you can't get a whole lot

[Vehicle noise]

23.01

UM Man .. we need (fuel) .. (fuel)

UM More in

UM Need fuel

UM Right here

[unspecified sound]

UM Do you want it poured

23.09

UM (Tip) it right here

UM ... got to say

UM You want me to pour it

BS .. will not be harmed

UM They're coming for

[Unspecified sound - movement noise]

[Vehicle noise]

BS That tower is off limits .. you should come down now and follow instructions .. if you are observed in the tower

[Vehicle noise gets louder]

BS If you come out now .. you will not be harmed

UM Right in front of the tower .. what'll I do

UM (Fire) away

[Unspecified sound]

BS Out of the compound carrying nothing .. come out of the building and walk up to or just follow instructions

[Movement noise]

[Unspecified sound]

24.20

UM/F They're in the building

[Vehicle noise]

UM Go

BS Follow all instructions as you leave the compound

UM/F They are coming in this time

[Unspecified sounds]

[Vehicle noise]

BS Follow all instructions you are under arrest .. after which you will be searched

[Sound of tanks]

24.39

UM Who (broke)

BS Do not go

UM Have you poured it yet

BS Do not carry weapons

UM Hm

UM Did you pour it yet

UM In the hallway yes

UM David said pour it right

UM D'you need

UM Come on lets go

UM David said we have to get the fuel on

BS We do not want anyone hurt -

UM Does he want it poured already

UM We want the fuel

BS - will continue to be delivered -

UM Yeah

UM We want some here

BS - out of the building .. put your guns down-

UF We need a gas mask

BS - Leave the compound now

[Unspecified sound - movement noise]

UM Gonna need fuel

UM More fuel

[Vehicle noise]

UM ... fuel .. I've got (no fuel)

UM Did you get any yet

UM water

[Vehicle noise]

[Movement noise]

26.02

UM Help me (pour) it

UM Yeah

[Vehicle sounds get louder]

UF No

UM Do you have a mask up there for me

UM no masks UM Is there a spare mask UM Are there no masks UM Did you here they hit the building [Vehicle noise] 26.52 UM It's their problem UM But don't pour it all out .. or we might need some later [Movement noises] [Vehicle noise] 27.09 UM Hey ... [Vehicle noise] [Movement noises] 27.16 UF/M Get ready for the gas .. throw all the tear gas back out UM Don't want .. don't want [Vehicle noise] [Movement noise] 27.30 UM that another vehicle The tear gas just .. just UM BS - leave the compound [Background speech] [Vehicle noise] BS UM Get back a little [Loud vehicle sounds] UF We know

BS - do not tear gas in the building -

UM They've broken through

BS - exit the compound now .. you will not

[Unspecified sound]

[Vehicle noise gets louder]

BS Exit the compound noise .. exit the compound now and throw out your

weapons .. we're not gonna let you stop in the tower-

UM

BS - the tower is off limits

28.31

[Movement noises]

UM realise now how they are hitting this building

BS - no one is allowed in the tower .. the tower is off limits-

UM Can we put out the light

UM No

UM Did somebody ask

BS -come out now .. you will not be harmed .. follow all instructions

UM Go .. come on .. we got to get us out of the building .. across the (room)

[Unspecified sound]

UF Hey in here

UM No

UM He's ...

[Movement noise]

UF Come on .. I think they're knocking the building down

UM Ten minutes

[Unspecified sound]

29.21

BS ... come outside

[Movement noise]

UM Would you get me one of those gas masks

UM Huh

BS come outside

UM Oh yeah sure

UM I didn't take any

UM ... this ones wrong

BS ... you are under arrest

[Unspecified sound]

29.35

UM I didn't take any

BS We do not want anyone hurt

UM We didn't

29.38

P They're pushing walls in

UM Where

P Hey hey

UM No you can hear it

UF They're behind

UM/F They're just waiting

BS - do not fire weapons .. do not fire any weapons .. we do not want anyone

hurt

UM What we gonna do .. you know just like right now

BS ... gas will continue to be delivered until everyone is out of the building

P They are putting .. start putting it in

30.05

UM Yeah they are not gonna stop .. what do you want do now .. if you think

they're gonna stop .. they ain't

P We could walk out of there ok

UM You

P Is there another gas mask somewhere

UM I don't know

[Movement noise]

UM Go get another mask

[Vehicle noise gets louder]

[Movement noise]

30.39

UM We need that

UM Have you got the fuel .. the fuel ready

UM I've already poured it

UM It's already poured

[Vehicle noise]

[unspecified sound]

31.09

UM

[Unspecified sound]

[Movement noise]

31.28

UM Do you want to go and telephone

[Movement noise - footsteps]

UM Hold it

P You got the there

UM

UM Yep

[Vehicle noise]

31.53

UM ...

P Huh

[Unspecified noise]

32.07

UM Whoa

[Vehicle noise gets louder]

31.24

UM They won't stop

UM The other tank went through it

UM

[Unspecified noise]

32.36

UM I thought they was (in) on us

UM Hang on to that

UM I think they would have killed us

UM What

UF There's another one gonna come in

32.49

UM You go on back upstairs

UM We're gonna want some of em

UM Ok .. they'll not turn around though

[Unspecified sound]

[Vehicle noise]

[Movement noise]

33.11

UM I wanted to see it

UM I didn't see it

[Loud vehicle sounds]

[Movement noises]

33.30

UM Where's the

UM Over there by the (wall)

UM I don't know

[Unspecified noise]

33.41

UM He's pretty decent

UM So you say

[Loud vehicle sounds]

34.19

[High pitched noise]

UM Anybody know how many soldiers they have

UM You got to put a figure on it .. I don't know

UM OK

[Vehicle noise]

[Unspecified noise]

35.20

[Movement noise]

UM Something began to creak

UM I don't know stairs

UM getting them in a panic

UM Right

35.55

[Sharp sound - unspecified noise]

UM .. there's no way of planning .. you can get ...

UM He's (following) with more

UF All the .. the kids .. you want the kids in the ...

UM What for

36.09

UM If you take em through em

UM What they doing now

36.16

UM Want me to do that (number) Steve

[Unspecified sound]

UM What is that doing

[Vehicle noise]

36.40

UM Like crazy

[Loud sound of vehicles]

36.54

UM Well they're moving on .. but they sure did (something) to the building

UM don't want anybody coming in

UM Nobody comes in huh

UM Nobody's supposed to come in

UM Right

37.21

UM They got some (fuel) around here

UM Yeah we've been pouring it

UM Pouring it already

UM We've got it poured already

UM Got extra fuel around here[extremely weakly in background]

UM You don't want to talk on the phone no more yeah

UM Ah we might be on the phone right now

UM No

UM They came close to it I tell ya that

UM Hello

[Movement noise]

BS - let me tell ya .. I repeat .. this not .. I repeat .. this is not an assault .. do not fire .. do not fire your weapons .. if you fire .. your fire will be returned .. do not fire .. do not fire .. the gas will temporarily render your building

uninhabitable .. exit the compound now and follow instructions .. you are not to have anyone in the tower .. the tower is off limits .. no one is to be in the tower .. anyone that is observed in the tower .. it will be seen as an act of aggression and will be dealt with accordingly .. if you come out now .. you will not be harmed .. follow all instructions .. come out with your hands up .. turn right .. come out of the building and walk up the roadway towards Double E Ranch road .. walk towards the large Red Cross flag .. follow all instructions .. to the red flag on the ground .. I repeat follow all instructions .. you are under arrest

39.28

UM If we come out they will arrest everybody

UM Huh

UM Want the phone

UM Hell no .. we just went so

BS Follow all instructions .. this is not an assault .. do not fire your weapons .. do not fire any weapons .. we do not want any one to be hurt .. the gas will be delivered until everyone is out of the building .. exit the compound now .. surrender to the proper authorities

UM Anything

David .. we are attempting to contact you via the telephone .. erm .. attempt to initiate contact telephonically with the negotiators .. if you cannot do that .. if you cannot do that .. if the lines have been cut .. indicate with a flag out the front door .. once again do not .. do not send anyone in to the tower .. the tower is off limits .. no one is to be in the tower .. send a flag out the front door to indicate if the phone line is no longer working or even if you do not have intentions to try to contact us help us to initiate telephonic contact .. once again this is not an assault

UM Do you know where David is

UM No .. I don't .. but he can hear

BS Do not fire any weapons

UM Better go and find him cos that's shot out

UM Ok

BS If you are attempting to contact us by way of telephone .. put a flag out the front door and we will try to make arrangements to reinitiate telephone contact .. let's get this resolved please David .. a long stand off is not gonna

help anyone we don't want anyone else to be injured

[Footsteps]

41.54

UM ... want it work .. put it on

[Footsteps]

[Movement noise & unspecified sound]

42.16

UM Is it ringing

UM No

[Vehicle noise]

UM Not working at the moment

UM keep calling em

UM Hm

UM They could ... those things really

[Vehicle noise & whirring noise]

UM Should have the way

UM Yes

UM Have it here soon won't you

UM I will be .. we'll see

UM Oh yeah

[Vehicle noise]

44.36

UM What was that

UM ... 10 thousand years

UM How long can we keep going

UM I hope you get .. kept your (stops)

UM I don't know .. no I don't think they did

UF Maybe the children ...

UM The (shooting) was so to them

UF (Why run just for that)

UM I won't

UM You guys all getting ready now

45.08

[Unspecified sound]

UM ... arrested me .. I don't know

UM Well they'll pull back

UM Well I tell you .. if I am

UM Are they gonna be long

UM They could come back

UM I know they can fight em but they're starting to clear out now so

UM Why do you think .. are the tanks pulling back

UM Ok

UM Are they pulling back .. are they

UM Yeah so far we can't control the (fuel) .. I tell you it's really confusing me ..

then he went said oh radio ... or something or about the line being

snapped

UM Don't trust him

[Noise level changes]

45.46

[Noise level changes]

UM Did he say something about the phones being cut

UM Yeah he did

UM Tell

UM All he said was that it wasn't working anymore

UM Well .. said if you want to make that

UM Well someone put a white .. a sheet out the window then

UM Someone put sheet out

UM Yeah there are two

UM Got a sheet ... or something

UM Yeah .. they will try and contact you

UM Yeah still got broken

[Movement noise]

UM This one even has a message on it .. about the phone line

46.58

UM Steve .. David

UM That'll do it .. just hold on to it

UM That went over straight on a line

UM Hey you know .. what if they take it as a surrender

UM We'll just hang it out the window then

UM This is the same guy

UM Well he said it wasn't working anymore

UM Do we have to keep all of it

UM Huh

UM We have to have a ... with it

UM What

UM In that case we'll be staying here .. what's going on

UM Don't know .. who knows

BS We are in the process of pushing tear gas into the building .. this is not an

assault .. we are not entering the building .. this is not an assault ,, do not fire

any weapons

UM Hey we got

If you fire .. fire will be returned .. this is not an assault .. the gas is not lethal not lethal tear gas .. the gas will temporarily render the building uninhabitable .. prolonged exposure can be harmful to you and your children .. exit the compound now ..you are not to have anyone in the tower .. the tower is off limits .. no one is to be in the tower .. anyone observed in the tower will considered to be an act of aggression and will be dealt with accordingly .. if you come out now .. you will not be harmed .. follow all instructions

UM David I want .. where is David

UF Is he over ...

UM Right here

BS -

UM David

BS

UM Yeah

UM They're gonna land on the tower

UM Who is

UM That's why they keep on insisting everyone out of the tower they're gonna probably land on it

BS - ... up the drive way

UM Can we hold them

BS - ... Branch road .. come out now and you will not be harmed .. follow all instructions

49.27

UM Oh

BS ... we do not want anyone hurt .. this is not an assault .. do not fire your weapons .. if you fire ...

47.14

UM Well if the phone line is dead has he got the flag out yet

UM No .. the problem here is that we don't have a sheet here .. if we'd sent them a message then we don't .. can't do a thing

BS -... gas will continue to be delivered until everyone leaves the ...

UM maybe

UM ... picked up their line there

Um Maybe I ... to now

49.45

BS - do not fire your weapons

UM just a chance that ... out the door

BS - ... exit the compound now and no one will be injured

[tape runs out on side A]

Side B - Tape 73 - Day 2 tape 2

0.06

UM Well

UM Got the phones

UM Do you know what they're talking about over here

UM They had accepted that they seen the signal

UM Great

0.34

UM Did you see much .. when you took the walk back there

UM I didn't no ...

UM Well I .. I saw em lying by the road but

UM Maybe they're pumped out

UM Sometime they'll be back through

UM They didn't realise I don't think

0.56

UM We should stay here for a minute .. then take the erm

UM Where'd David go back up huh

UM He went to

UM Did you run a flag out the front there

UM Maybe .. maybe that's why they probably stopped for a minute .. notice that

Byron's stopped talking with (you)

UM Yeah sure ...

UM He would have there

1.24

[Movement noise]

[Noise level changes twice]

UM I feel like ... quite a bit of it yeah

UM Yep

UM I got a good dose of it

UM So did I

UM Make you all ... don't it

UM Yeah

UM It makes you feel awful

UM Sure makes me feel like that

[Vehicle noise & unspecified sound]

UM ... putting the line in

[Vehicle noise & unspecified sound]

UM God's given us a big lead

UM Hm mm

[Movement noise]

[Vehicle noise]

2.38

UM Don't want to from that

UM Alright drop it .. now that's gone .. we don't have to do that again

[Movement noise]

[Vehicle noise]

2.50

BS David

[Vehicle noise]

BS We have observed the flag outside by the front door .. you need to get info to us whether or not the phone is working .. or whether or not you have thrown the phone out of the building .. if in fact the phone is working please initiate contact with the negotiators now .. if it is not working -

UM In there

BS - if it is not working .. you will have to get that message to us with the first people coming out of the compound .. this siege is over .. David please [movement noise] .. it is time for those people to come out -

UM Not

BS - so they bring forward the message ...

UM Wait

3.29

BS - and reattempt to reinitiate contact at that time .. gas will continue to be delivered until everyone is out of the building .. exit the compound now

[Movement noise]

[Vehicle noise]

3.45

BS You can retrieve the flag if it was in fact hauled out or reinitiate contact with negotiators .. That line is not operational -

UM Wendell

BS We'll have to work on getting another to work on another phone

UM He's back there

BS - delivered .. in the meantime you have got to realise this stand-off is over ..

you are under arrest at this time you need to comply with instructions and
exit the compound

[Movement noise]

[Vehicle noise]

4.27

UM So at the moment they have more gas ready to go

BS David .. Stephen if you are trying to go back on the phone .. if you're attempting to get back on the phone .. retrieve the flag and address it with a different coloured instrument

4.45

UM Steve

UM What

BS If you are attempting to get back on the phone retrieve the flag -

UM Retrieve the flag and put a different colour out

[Movement noise]

BS - with a different coloured -

UM For what

UM You want to leave it outside .. they don't seem to be doing anything

BS - is not operational

UM Where's the fl.. where's another coloured flag or cloth or something

[Vehicle noise]

UM Hey

UM What about things in those laundry .. you know

5.07

UM I need some kinda .. you can pull it through

UM Hey do they red or anything

UM Brown

UM Got what

UM They've asked you to throw out a flag

UM They're asking us what

UM Can't do it

[Movement noise]

5.33

UM Steve

UM Yeah

UM Hey hey

UM Steve

UM I'll get him

UM Okay

[Movement noise]

5.36

UM Hello Steve

UM I'm up here

UM Yeah

UM I'm gonna come down

UM Ok

UM Go down to the cellar

UM Take a torch down .. but don't let it ...

UM Ok

[Movement noises

6.05

[Movement noise]

6.05

UM Getting a little bit foggy in here ...

[Movement noise]

6.35

UM Is that as far as that goes

[Movement noise]

6.46

UM Going on huh

UM Yeah

UM Really

[Movement noise]

UM Good

[Movement noise]

UM That is red

UM Ok

UM That's it

UM I can't make it (Steve)

UM Well ok

[Movement noise]

UM Just to make sure I can get down

UM They're only going round there

[Movement noise]

7.25

David .. none of its done and you have had enough time .. you must exit the compound .. it's time to exit the compound in an orderly fashion .. we have observed the red banner .. it is the opinion of he commander that we will continue to attempt to contact or communicate with you .. however it is time .. for you to exit the compound in an orderly compound .. we have received reports that although we have not initiated fire towards .. there has been fire heading in towards the ...

8.00

UM I can't ...

UM No way

BS We are not in a position to place our agents in jeopardy to deliver a phone to you at this time

Um ... we never fired .. no way

[Background noise]

8.18

BS If you intend to come out at this time place a flag out the front door and we will ensure you have a safe exit from the compound .. if you intend to come out at this time .. change the flag at the front door and we will ensure you are exiting into a safe environment

[Movement noise]

UM It'll take a while you know

8.43

BS We are in the process of delivering tear gas into the building .. this is not an assault .. we are not entering the building .. not an assault do not fire your weapons .. if you fire .. fire will be returned .. do not shoot this is not an assault

UM Here we go

BS The gas that you smell is a non lethal gas -

UM is ready

UM No

BS -that will temporarily render the building uninhabitable

UM These are here ...

9.13

BS Exit the compound now and follow instructions

UM No .. no way

BS Do not .. do not have anyone in the tower .. the tower is off limits .. no one should be in the tower .. anyone observed in the tower will be considered doing an act of aggression and will be dealt with accordingly .. if you come out now

UM

BS - come out now you will not be harmed -

UM What's he talking about

UM I don't know but ...

BS - follow all instructions .. come out with your hands up -

UM He said that we had fired and they will not deliver the phone

BS - in an orderly fashion .. carrying nothing -

UM Ok well what we gonna do

09.58

BS Come out of the building and walk up the driveway towards the Double (E)

Ranch Road and follow the instructions for what to do .. there will be a large

Red Cross flag .. which will be a

UM Alright .. what do we say

BS - you will be treated professionally .. you will not be injured .. follow all instructions in the Bradley armoured vehicles .. follow the instructions ..

you are under arrest .. this stand-off is over .. you are under arrest .. the stand-off is over .. we do not anyone to be hurt .. follow all instructions

UM (Breather's) open

UM

UM In here I have

BS Come out of the compound and lead em out in a safe and orderly fashion

10.48

UM We can't get a phone in to work

BS Follow instructions

UM That's why we're asking if they can -

BS This is not an assault .. do not fire any weapons

UM - can't get that one to work ...

BS We do not want anyone injured -

UM (There's no one) to step up there

UM You want to try that

BS - David .. Steven .. all of you have .. we've talked with you for so many days .. we do not want anyone injured .. the tear gas will continue to be delivered

until everyone is out of the building

UM David

11.18

BS Exit the compound now - exit the compound now .. David .. Steven .. if you

intent to exit -

UM We could (mend) the wires

11.31

BS - produce the

UM Ok ..we are not

BS - the same white flag prior to a new form of do it now

UM Ok .. they're not gonna stop until

UM We knew nothing about it

[Movement noise]

11.56

BS David .. Steven .. I've been advised that if you are not exiting within the next

two minutes additional gas

UM Get him on back now

UM Yep .. I don't know what else to say

BS - will be inserted into the building .. this is not gonna end David .. until you

exit in a peaceful and orderly fashion .. gas will continue -

UM Ok (test) that phone

BS - to be delivered until everyone is out of the building

UM Put the phone down here

BS There is no compromise -

UM Alright

BS - in that position .. you are under arrest and this stand-off is over

UM Do the best with the

12.14

BS -exit the building now in an orderly fashion and no one will be injured

[Movement noise]

UM We can move down to

UM Where's your gun

UM I'm nursing it

UM Yup .. you mean it's just gone on too long .. you know

[Movement noise]

UM Did you stop her

UM I don't need her

UM/F Where she gone

12.56

UM Unlikely

UM Going to her man you know

UM Yeah

UM I don't think they're real too crazy about going on

[Movement noise]

UM You figure they put the wire on

UM Yeah sure

UM Told you I (like) mine

UM They're getting some wire here

UM Yeah I know

UM ... are they doing

UM They are getting Now

13.35

UM I don't see them

UM Don't stay in .. in your post windows

UM Dave

UM Yes

UM Breathe .. it allows you breathe with the mask

UM You get a mask on

UM Put your mask on

UM I rather go down

UM Through the mask .. don't take it off though

UM Well all right .. shift in here .. that's what we ought to do right

UM Ok

[Background speech]

14.36

UM Alright in here guys

UM Oh yeah

14.53

UM Oh yeah .. and its not bad

[Background & movement noise]

15.28

UM So what it is that's gonna (crash) this thing

UM I hear ya

UM They did if they want to come home

UM You ok

UM Yup

UM You need a

[Movement noise]

UM Are they coming

16.11

[sirens]

UM Here they come

UM Do you know if Steven's here yet

UM No he's not here yet

[Movement noise]

[Footsteps]

[Footsteps]

UM ... not out there

UM Oh I don't know .. I thought he was up there that's all .. I knew he was going

upstairs for something

UM Well I don't know

UM I don't know

17.15

UM Here it comes

UM Did you people take the other stuff

UM We sure did .. yeah

UM Oh they need up yeah .. the others are not in there

UM No you need to stay here with me

UM I was with Steven there

17.47

UM/F Do you know what they are gonna do

UM Who knows .. the vehicles are gonna .. she's gonna come you know straight

through the walls

[Unspecified sound]

UM Not working at all man

UM Oh

[Unspecified sound]

18.14

UM Ok we got less than that now

UM [makes brrrmmm sound]

UM (Doug) .. can you see a little room

UM Sure yeah

UM And at least they ... with me outside

UM I guess they have started

UM Here we go

UM Well what we do we get that .. hey don't wipe your eyes

UM Hey .. here's some more gas masks .. who needs them .. here .. take some to

the ...

UM We've got no gas masks

UM That's right ...

UM They need em upstairs .. then run upstairs and get em

UM Watch it Charlie

UM Get some more masks here

UM All right go upstairs David

UM No just stay right here .. we're alright

UM Okay

BS This is not two minute warning

UM Ok again .. they are on this side of us this time .. I'll kick the window out

Will continue to be delivered until everyone is out of the building .. the gas will continue to be delivered until everyone is out of the building .. exit the compound now .. come out in an orderly fashion .. no one will be hurt .. you will be treated in a professional manner .. exit now and no one will be hurt .. if you do not comply with the two minute warning additional gas will be introduced into the building and will continue to be delivered until everyone is out of the compound .. exit the compound now the compound .. you are under arrest .. this stand-off is over

UM Have you heard it

BS We do not want anyone to be hurt

UM David

BS

BS Follow all instructions .. this is not an assault .. do not fire any weapons .. we do not want anyone to be injured

UM In here's good

BS The gas will continue to be delivered until everyone is out of the compound .. exit the compound now and surrender to the proper authorities

[Movement noise]

UM The picture's getting horrible

UM How many have been affected

[Vehicle noise]

UM Can we have a light in here

UM What do you say

[Vehicle noise]

21.46

[Vehicle noise]

22.19

UM They certainly where to put that stuff

UM Yeah

[Movement noise]

UM Gotta go

UM They wanted you to come into contact that went

[Music starts]

23.03

UM David

UM You ok there

UM Well I'm done

UM Ok

UM I've got to stay here

UM They just got the situation on K R L D

23.28

UM You want a hand with that

UM No it's alright

UM Stay tuned

UM What did he say

UM Don't ask me

UM What'd he say

UM

UM

UM There you are

UM/F I could see you were (praying)

24.00

UM So we got something coming right

UM we have

UM/F Huh

[Movement noise]

UM ... bullshit

UM They're are gonna send something through the walls

UM/F contact on that

UM Down round the back there

UM Well that figures

UM

UM Right here

UM Yeah guard the (entrance)

UM You better check on em real quick

UM Coming through

UM He's going around with him

UM Are you well

UM I'm great

24.53

[Movement noise]

UM Will somebody help me with the (rocks)

UM So why can't they put up there .. staying in one area

UM Jennifer .. does anybody still need one

UF Uh not that I know .. not right this second

UM Yeah .. I need to have one .. ok

UM Hey .. I'm having trouble getting em to move into the middle .. their in

danger

UF three times

[25.35]

[Movement noise]

UM Don't try to (light) it

UF They were gone

UM I hope they were drinking water

[Movement noise]

26.09

UM Ah they've put it through to keep the

UM Who .. what

UM I don't even

UM Bullshit

[Whistling .. background speech]

UM There's some water over there

UM I've got the ladder down here

[26.40]

[Movement noise]

27.10

[Loud hissing noise]

UM Look they're coming

UM I don't see em

[Loud hissing noise]

UM You okay

[Movement noise]

UM Huh

UM You alright

UM You Ok

UM We don't know where Marsh is but you know .. anyone know where Marsh

is .. Grace has gone out there and

UM Probably

UM Aw geez and the stake-out

[Movement noise]

[Vehicle noise]

29.40

UM Another ones through

UM Behind the

UM Already .. well they haven't sent

30.44

If you fire .. fire will be returned .. do not shoot .. this is not an assault .. the gas you smell is a non lethal tear gas .. this gas will temporarily render the building uninhabitable .. exit the compound now and follow instructions ... you are not .. I repeat not to have anyone in the tower .. the tower is off limits .. no one is to be in the tower .. anyone observed in the tower will be considered to be engaged in an act of aggression and will be dealt with accordingly .. if you come out now you will not be harmed .. follow all instructions ...come out with your hands up .. carrying nothing .. come out of the building and walk up the driveway towards Double E Ranch Road .. walk towards the large Red Cross flag .. follow all instructions of the FBI agents in the Bradleys .. you are under arrest .. this stand-off is over .. we do not want anyone to be hurt .. follow all instructions .. this is not an assault .. do not fire .. I repeat .. do not fire any of your weapons .. we do not want anyone to be hurt .. gas will continue to be delivered until everyone is out of the building .. exit the compound now .. permit yourself to surrender to the proper authorities ..do not subject yourself or your children to any further discomfort .. place the (right) flag out of the door to indicate that you're ready to exit .. this stand off is over .. it is time to come out now .. it is time to come out now

[Movement noise & background noise]

34.12

BS

UM Heard none of em fired at me

UM There should be to know that

UF Gas around for a few minutes

UM Hey whoa

UM Your used to it .. I'm not

UM The gas sure

UM Since that damn sprayed me tear gas man .. you take a pee yet .. you take a pee and that tear gas burns up your dick

UM ...[laughter]

UM oh okay .. now I know

UM Hell no

UM But it does

UM Whoa

UM Still burning

UM Hey .. moved the cars right

35.31

UM Nothing

UM Hey Stephanie .. you're a real nice lady ... looking very pretty

UM Hey that's

UM I don't know

[Background noise]

UM Its all with the tear gas now so

UM Who'd you pick

UM Posted that letter to the

UM ... did you pick him

UF No

UM You want to go downstairs and pray

UF No .. I would have gone yesterday

UF They got all the money

UM Hmm .. well they're still out there

UM They are not gonna let em go out the window man

UM How could they have let em do that

UM/F You won't get

UM Broke .. it is broke .. it's too smart

36.53

UM That's good

UM Real quickly you can order the (fire) yes

Um Yeah

UM All right you

UM ... the television audience

UM Its ok .. Jerry don't do it too early you'll (burn)

UM I bet we could really go to town on a

37.34

UM Alright .. Ok

UM I was gonna take my trip but I guess I would written there .. I'd be

embarrassed

UM Don't have time .. we go over ...

UM Where's Jerry

UM Jerry .. I checked everything out .. this is one thing that I didn't check last

night

UM Ok

UM What is there to do

UM I'm not sure

UM They almost panicked

UM Right I was supposed roll up in ...

UM It was right where we left it .. but it wasn't suggested that we'd all at

midnight

UM Wayne filled them big bags that we got right here

UM Wayne got them ready .. I mean today

38.19

UM Agree that .. you're the best

UM That's why we're doing it .. really

38.42

UM Can we have that package arranged

UM What

UM Do you want it now then

UM Yeah

UM Okay .. somehow we'll do it another way

UM It means going outside

UM Yeah Ok

David .. those of you remaining in the Branch Davidian compound .. we are continuing to introduce tear gas into the building .. this is not an assault .. we are not entering the building .. you are not going to be subjected to any fire unless you fire upon the agents in the proximity of the compound .. do not fire your weapons .. if you fire you will be fired upon .. do not shoot .. this is not .. this is not an assault .. the gas you smell is a non lethal tear gas .. the gas will temporarily render the building uninhabitable .. exit the compound now and follow the instructions .. David .. Steven .. we have covered the instructions previously .. I'm gonna go over them again .. you are free to exit the compound in an orderly manner .. exit the front door after displaying a white flag to ensure that the agents outside are prepared to receive you .. we are prepared to receive you at this time .. exit the compound -

UM White flowers

BS

-the front door and turning to the left .. walk down the driveway towards Double E Ranch Road and you will receive specific instructions from the FBI agents in the armoured vehicle .. exit the vehicle or exit the compound at this time and you will be provided immediately with proper medical attention to assist in reducing removing and relieving the difficulty from gas .. you need to come out of the compound immediately .. gas will continue to be delivered into the compound until everyone has exited .. you are not to have anyone in the tower .. the tower is off limits .. no one is to be in the tower .. anyone observed in the tower will be considered to be an act of aggression and will be dealt with accordingly .. do not have any weapons in the windows .. if you come out no one will be harmed .. when you come out

no one will be harmed .. follow all instructions provided to you .. come out of the compound with your hands up .. carrying nothing .. come out of the compound with your hands up .. carrying nothing .. come out of the building and walk up the driveway towards Double E Ranch Road .. David this is exactly as we have discussed previously .. please you exit the compound walk up to the driveway towards Double E Ranch Road and you will receive appropriate instructions at that point in time along with remedial medical care and transportation .. walk towards the Red Cross flag .. follow the instructions of the FBI agents in the Bradleys .. you are all under arrest .. this stand off is over.. we do not want anyone hurt .. this is not an assault .. do not fire any weapons .. if we can we can end this peaceably .. we do not want anybody injured you will not be hurt ..come out of the building ... there is no variance and there is not compromise .. the gas will continue to be delivered ... [vehicle noise] the compound now .. there is absolutely no reason to subject yourself and your children to any more discomfort .. place the white flag out of the front door to indicate your readiness to exit with the first group of people .. we are ready for you

44.04

[Vehicle noise]

UM ...

UM They're sitting outside the door and I think that they've got er ...

UM If they come in ... then their coming in

UM They're on the other side

UM I'm thinking backwards .. we can always (burn) it

UM We use the Room

UM Ok

UM We're going through Ok

44.53

UM got a lot of them along here .. so they want to

45.17

UM Listen ...we want these people at the gate .. people up at the gate

45.37

UM We're kind of

UM You don't think that they've

46.12

UM They're gonna want to speak with David about that.

UM Ok

UM We'll just have to

UM What happened

UM I've got a lot of people going with you Ok

47.07

UM Alright now

UM Yeah

UM The guy on the radio mentioned that er ... he didn't think they would ... and

gas is going in ... I don't know if they got out here yet

UM No

UM They are gonna end this

UM It's a little warm out there I'm telling ya

UM Warm

[Movement noise & Background noise]

[End of Side B Tape 73-2]

Transcript

Lab ref: 00053/CMM/10

Tape ref: Enhanced copy of 73 Day 2 Tape 3

Key:

.. Natural pause

.... Indecipherable

() Sounds like

[] Descriptive text

- Continuation of speech

0.00 Cassette run time in minutes and seconds

D David Koresh

S Stephen Schneider

BS Byron Sage

UM Unknown male

UF Unknown female

C Child

RBM Radio Broadcast Male

RBF Radio Broadcast Female

80.00	
UM	
UM	Are you you have to do that
UM	through the window
UM	
UM	It's always right how the hell was they supposed to know what was
UM	
UM	How you doing
UM	Got more gas
UM	
UM	What
UM	
UM	Maybe we need to know what we're gonna if
UM	You can tell him that the bulldozers there
UM	
UM	
[Movement noise]	
UM	And pretty soon they'll have us out here
1.03	
UM	Ain't no
01.08	
UM	He was supposed to do it
UM	(Pete)
[Move	ment noise]
[Vehic	le noise]
UM	They're down the side
[Move	ment noise]

[Unspecified sound] UM There you go UM Whoa whoa whoa [Unspecified sound] UM Don't fire .. they've UM Don't fire UM Don't fire [Movement & Background noise] 02.10 UM I don't know .. we'll have keep an eye UM Why not .. they're here UM (Pat) .. thing is they just rammed into the wall UM Gas .. gas UM Look at the gas .. damn UM What kind of gas is it UM Tear gas .. right in there UM And now we've they are through to a side vent UM You're damn right UM Rammed the walls .. the only thing certain is that the wall is going over UM Yeah UM Sit down .. get down .. you must put a mask on UM You must have a mask Which one UM 02.48 UM Gas .. yes [Background speech] UM You've got to put the fuel in there too UM Is it dry UM Hey lets put loads of fuel in here

```
UM
      Fuel
UM
       That's wrong man
UM
3.06
[Background speech and noise]
UM
       Maybe I could get it (flowing) again
UM
       .... Ok
3.13
UM
       That's wrong that
UM
       I'm just not gonna do that
UM
       Go and get some more ....
UM
       So we're gonna wait at ... down there
UM
       There .. (all depends)
UM
       I dunno .. I don't have more than ...
UM
       Want some more
[Movement noise]
3.32
UM
       Is there a way to spead fuel here
UM
       Ok .. what we do .. you don't know
UM
       I know that won't spread .... Get some more
UM
       So we only light it first when they come in with the tank right .. right as they're
       comng in'
UM
       Right
3.47
UM
       That's secure .. we should get more hay in here
UM
      I know
[Movement noise]
3.50
UM
      I don't think that can do ours ....
```

```
[Background speech & background noise]
3.54
UM
       They are just spraying it all over to get us out
UM
       Get out of here
UM
       .... block the door
UM
       Ok
[Vehicle noise]
[Background speech]
UM
       You all ready
UM
       Yeah
UM
       They've instructed that they have to leave the building
UM
       . . . . . .
[Background speech & noise]
5.13
UM
       Guess it would
5.18
[Vehicle noise]
UM
       Can these (rooms) take even more
UM
       ... the fuel
UM
       . . . . .
UM
       . . . . .
UM
       You have to spread it so get started Ok
UM
       Yeah .. got some cans there
UM
       Right here .. two cans here .. and that's ... and the rest can take em ....
5.38
UM
       Sometimes we don't know that ....
       Somebody took one can and spilled ... on the ground
UM
[Movement noise and vehicle noise]
5.52
```

UM Tell us what they want us to do [Vehicle noise] UM How longs he been back [Background speech] UM Did he tell you UM Don't want him to know though UM Don't want him to know we've got (gas) here UM Won't get to know unless you let them through UM You're the guy's who telling them what to do Um We're sending some of them through now UM UM No time for UM I just gotta 6.49 [Unspecified sound] UM Noo-ope 7.04 UM We think we might get another go at the phone UM Sure UM Yeah Lord .. you are raising a storm and the whirlwind UM We're waiting UM We're waiting Lord .. all we can do is wait UM Yeah way to go ... think they'd move up again .. wait for em coming UM It looks likes ... because all day we'll wait .. waiting 7.13 UM Hold em off .. that's all we gotta do 07.21 UF Did you try the line again UM What

UF Did you try the line again [Background speech] UM Oh thank you .. ok ... anyone else want little bit .. so it's not such a bad thing as long as UF UM Pardon UF They coming yet UM UF It's rather odd UM I know .. where is everybody outside now UF Um up in the (loft) .. they're Ok UM Any of you guys [Vehicle noise] [Movement noise & Background sounds] 9.22 UM Better get all this stuff off the floor and get it away from the gas man .. is that still Ok UM Hm UM What's wrong with you UM Oh .. sorry I started all this .. it's no good BS - ... time to leave the compound UM They're .. they're gassing right now I tell you that BS ... this is not an assault-UM Problem with BS - It's not an assault .. we are not approaching the building .. do not fire your weapons .. if you fire will be returned UM hadn't fired the gas at us UM I wish they had ... gun with em BS -do not shoot your weapons-

UM We cannot defend without guns

-the gas is non-lethal tear gas .. it will temporarily render the building uninhabitable .. that gas will eventually permeate your food you're clothing the water .. exit the compound now and follow instructions that have throughout the stand off .. you are not to have anyone in the tower .. the tower is off limits .. no one should in the tower .. anyone observed in the tower will be deemed an aggressor and will be dealt with accordingly .. come out now you will not be harmed .. follow all instructions .. come out with your hands up carry nothing .. come out of the building and walk up the driveway towards the Double E Ranch Road .. follow instructions-

UM can't get in here

BS - ... the Bradley's .. you are under arrest .. this stand off is over .. David Koresh no longer directs the compound .. we don't want anyone to be hurt .. follow all instructions .. this is not an assault .. we are not coming into the building

[Vehicle noise] do not fire -

UM

BS -it is time to surrender -

UM If they get anything off or ... they'll get confirmation .. they'll tell them ...

BS -do not subject yourself or your children to any more discomfort .. come out from the building now .. you will now leave the building .. David Koresh will not any longer direct your activities in the building

[Vehicle noise]

13.06

[Movement noise]

13.28

UM

UM Yeah

UM Boy they are sure moving along

[Vehicle noise] [Movement noise] [Vehicle noise] [Unspecified noise] 14.14 UM Move away UM Do you know where David is UM **Upstairs** UM Oh Did David go up this way UM UM Yeah [Vehicle noise] 14.29 UM You know where David is .. we are ... UM Don't you know where David is 14.36 [Movement noise] UM He's not here .. I don't know UM I dunno where he is UM I dunno .. but I saw him upstairs 14.55 UM ... go upstairs UM David is not so [Background speech & noise] 16.30 [Siren in the background] [Movement noise] 16.39 UM I'm going to (transfer) upstairs

UM It's down the hallway towards David end Ok .. white door on the left UM You going up UM No 16.49 [Footsteps] UM David UM Hmm UM They should go and find out about the children Ok 16.55 UM Here UM When he comes down he'll make that order UM I don't believe that David will lose control UM Well he's going down at sometime to see David UM They're sending a lot UM Huh UM See him about what UM Breaking out now would be a (dream) UM Yeah but don't 17.19 UM I'm not UM Like I said ... [Background speech & noise] [Movement noise] 17.44 UM Where's he gone [Movement noise] [Footsteps] UM They won't turn around now Ok

[Background speech & noise]

UM We want to (haul) it on over UM You really think that is [Movement noise & Background speech] 18.25 UM Look at the will you UM You want me to do that .. want a hand with some of that [Noise and background speech] 18.45 UM Where they stand (boys) 18.49 UM If they took out the (blue ridge) this whole big thing you know UM They're getting to that 18.56 UM They didn't think they had line so they haven't fixed it UM Where is he .. where's David .. where's David 19.04 [Knocking sound] [Sound of footsteps] UM He's not coming down [Sound of footsteps & background speech] 20.55 UM You sitting there UM Alright [Movement noise and background speech] [Footsteps] 21.28 UM Wait a minute .. did you hear about going up to (David) UM UM You may have ... to see (David)

UM No

UM Okay when the next guy comes down .. you go up and see him Ok

UM Hm hmm

21.42

UM If I use the phone right there .. there's nothing on it

UM Go up and see him

BS - ... David those of you remaining inside the Branch Davidian Compound ..

we are continuing to introduce tear gas into the building .. this is not an assault

.. we are not entering the building at the time .. we are not entering the

building at this time .. this is not an assault .. do not fire your weapons .. if you

fire .. fire will be returned .. do not shoot .. this is not an assault .. the gas you

smell is a non-lethal tear gas .. the gas will temporarily render the building

uninhabitable

UM Well we're ... stay here .. I don't want anything coming in

- the gas will eventually permeate all the food clothing and water supply .. exit the compound now and follow instructions .. the exit and evacuation plan is the same as that which we have discussed throughout the stand-off .. you will come out of the front door in an orderly fashion .. after displaying a white flag indicating your immediate departure .. walk down the driveway towards Double E Ranch Road and follow specific instructions provided to you

UM You can hear it ... why can't we leave

be in the tower .. any movement observed in the tower will be considered an act of aggression and will be dealt with accordingly .. you are responsible for your own actions .. if you come out now you will not be harmed .. follow all instructions provided to you .. when you come out .. come out with your hands held high .. carrying nothing .. come out of the building and walk up the driveway towards Double E Ranch Road and medical attention will be provided to relieve your discomfort

UM To relieve your discomfort

- walk towards the towards the Red Cross Flag .. follow all instructions the FBI agents in the Bradley's provide to you .. you are under arrest this standoff is over .. David you are under arrest this stand-off is over .. come out and you will be treated professionally .. your needs will be addressed which we have promised you in the past .. the time to delay is over .. we don't want anyone hurt

UM They are not going for David

BS - follow the instructions provided

UM The FBI is ...

UM - this is not an assault .. do not fire any weapons .. we do not want anyone to be hurt .. submit to the proper authorities .. gas will continue to be delivered until everyone is out of the building .. David .. Steve one of you probably need to realise that this is not going to end until all of you are out of that building .. gas will continue to be delivered in an increasing volume until everyone has left the building .. exit the building now .. do not submit yourself and subject your children to any more discomfort .. you are unable to hold the white flag outside of the front door to indicate you're readiness to exit .. we are ready to meet you and provide you with the appropriate medical attention to reduce your discomfort as a direct result of the tear gas .. please the time is now .. come out of the building .. let's get this over with

26.18

[Footsteps]

UM Alright

[Footsteps]

26.41

UM this again

UM Huh

UM We don't need to go

UM Hm UM We don't need to go UM No what you wanna do UM Hm UM ... wanna do UM Hm .. they marked you Um Yes I know [Vehicle sounds & unspecified noise] 27.30 UM God is here UM Is he UM God is here UM UM He says the signs are (good) UM Yeah .. they're not good UM How you doing there UM They are .. on their way [Sharp unspecified sounds and vehicle noise] 27.58 Means more waiting UM[Movement and vehicle noise] 28.33 UM I bet its gonna spread out on the roof UM That's it [Background speech & vehicle noise] 28.45

UM ... going to jail around here

UM

[Movement noise & footsteps]

28.58 UM Most guys would do that UM Bob .. Steve's calling for you UM He called to warn you UM I didn't think UM No (lets kneel) and UM Will God help us today UM If there's ever 29.19 UM ... you not telling me that they don't know UM No .. no 29.25 UM If he wasn't coming down he'd tell me .. you may as well UM Right [Movement noise] 29.35 UM (Gary) you go up already UM Yeah .. already been [Movement/background noise & background speech] [Vehicle noise] 32.11 UM Has (Bray) gone up yet UM Who UM (Bray) UM Probably UM I dunno .. probably UM Yeah yeah he went in his room 32.20 UM man at the top

UM I say we all loosen up .. he's been out of it

UM Well what do ya wanna do

UM Well maybe and pray

UM they're coming

[Movement noise & background speech]

32.53

UM No way we can get ...

UM You ... calling us (bad) again

[Movement noise & background speech]

33.44

UM You going to see him

[Unspecified noises and background speech]

[Vehicle noise]

34.48

UM No way whoa .. another er bulldozer coming out to sting us .. elevated

[Vehicle noise]

UM You don't have any ... do you

UM Yeah make it quick (partner)

UM Don't hit em

UM Damn

35.12

[Vehicle noise]

[Background speech]

[Movement noise]

36.18

UM Staying at the door man

UM Gonna wear it like a mask

UM It's running

UM All I can see is a little bit of it

[Movement noise & unspecified sounds]

37.10

UM try to use

[Movement noise]

[Vehicle noise]

37.49

BS - David .. Steven and the remaining members of the Branch Davidian compound .. we are continuing to place tear gas in your building .. this is not an assault .. we are not entering the building at this time .. this is not an assault .. do not fire your weapons

38.07

UM Ok they can't come through into the building yet

BS - If you fire .. fire will be returned .. do not shoot .. this is not an assault .. the gas you smell is a non lethal tear gas .. the gas will temporarily render the building uninhabitable .. the gas will eventually permeate your fabric your clothing and your food supply .. exit the compound now .. follow instructions discussed at length throughout this stand-off .. you are not have anyone in the tower .. the tower is off limits .. I repeat the tower is off limits .. any movement observed in the tower will be considered an act of aggression and will be dealt with accordingly-

UM Hm

UM I think I gave him one

UM Ok

[Vehicle noise]

39.09

BS - if you come out now you will not be harmed .. follow all instructions

UM I think this

BS -come out with your hands up .. carry nothing come out of the building come down the driveway towards Double E Ranch Road-

```
UM
BS
       -and medical attention will be provided to relieve your discomfort
[Vehicle noise]
39.17
BS
       -follow the instructions of the FBI agents in the Bradley's .. you are now under
       arrest .. this stand-off is over .. come out and you will be treated professionally
       .. we do not anyone to be hurt .. this is not an assault
[Vehicle noise]
39.37
BS
       [On tannoy] Do not subject yourself or your children to any further discomfort
       .. come out of the building now
[Vehicle noise]
BS
       - come out of the building
39.58
[Vehicle noise]
42.18
[Background speech]
[Vehicle noise]
43.22
[Movement noise]
45.24
UM
       What exactly do you want to know
UM
       Where does that go to
[background speech]
45.37
UM
       Hold ....
[Background speech]
UM
       Did David say it
UM
       He did
```

UM He gave us express ... to think .. do the thinking

UM Really

[Background noise & movement noise]

47.01

[Footsteps and movement noise]

47.25

[End of Side A]

Side B of Tape 73 - Day 2 - Tape 3

0.19

[Vehicle noise]

[Movement noise]

1.16

[Footsteps]

[Background speech]

[Footsteps]

1.52

UM Just leave it here

UM No way .. no way man

[Background speech]

2.28

UM Right .. we're gonna (waste) that fuel over here

[Background noise & speech]

02.55

UM No we said we'd do this

[Background speech]

3.00

UM They're vulnerable .. they are right outside

UM Now I have to take time doing this

UM Hmm

UM They're right outside now

UM No they are still long way's

[Background noise & speech]

03.25

[Movement noise]

```
3.38
UF
       I said to ....
UM
       Where do they think ....
[Movement noise]
[Background speech]
04.04
UF
       They'll ... for anything won't they
[Movement noise]
[Background speech]
5.14
UM
       If they give me enough grounds I'll .. in fact ....
UM
       ... if you take that on are you gonna ...
UM
       9.40 that's .....
UM
       That's right
UM
       ..... three of em .. go check on the radio ..... you could go and check
5.42
[Movement noise]
[Background speech]
[Movement noise & background speech]
6.12
UM
       I know that ....
UM
       Got your own water
UM
       Is that ... alright
6.26
UM
       ... the water I think
UM
       Anybody want to take a drink .. of water
UM
       Hmm mm
[Background speech]
6.40
```

UM You've got water in the ... got some water in my tub .. in my UM Oh er don't forget as long as you got water UM Not good to drink after (ssh) 6.48 UM I thought the water was no good UM Any of you guys want a drink of water UM Not good is it UM ... is that the one ... 07.05 UM Hey you guys [Background speech] 07.10 UM No .. I'm gonna drink that one [Background speech] UM What are you doing ... 7.25 UM Remember there's nothing else you gotta do UM Yeah UM Oh yeah [Footsteps & movement noise] 7.31 UM Remember this is a ... you got UM Uh huh [Movement & background speech] BS - David ..Steven remaining in the Branch Davidian compound .. we are continuing our efforts to ensure these efforts are not meant to injure anyone at all .. we will continue to introduce tear gas into the building .. in an effort to direct you out of the building .. this is not an assault .. you are not .. do not

come out of the building with any type of weapon or anything that will appear

to be a firearm .. we do not intend to enter your building at this time .. this is not an assault .. do not fire your weapons .. do not appear at the windows with anything that [unspecified sound and movement noise] ... a weapon .. if you fire your fire will be returned .. do not shoot .. this is not an assault .. the gas you smell and will continue to smell is a non-lethal tear gas .. the gas will temporarily render the building uninhabitable .. and by temporarily I mean as long as it takes to get each and everyone of you peacefully outside of that building .. the tear gas will continue to be introduced and will eventually permeate everything .. the water supply .. it will permeate your clothing and ruin your food .. exit the compound now and avoid any further discomfort .. exit the compound and comply with the exit [unspecified sound] evacuation plans that we have been discussing for weeks .. the plan will be the same as previously discussed .. please move in an orderly fashion from the compound [unspecified sound] down the er the driveway .. -

UM ...

BS

-towards Double E Ranch Road .. [movement noise] do not under any ... anyone in the tower .. the tower is off limits .. no one is to be in the tower .. movement observed in the tower will be considered an act of aggression and will be dealt with accordingly .. you are responsible for your own actions .. if you come out now you will be treated professionally and no one will be harmed .. follow the instructions provided to you by the FBI agents immediately upon your exit .. come out with your hands up carrying nothing .. do not have anything in your hands or on your person which [movement noise].. could be construed as a possible weapon .. come out of the building and walk up the driveway towards Double E Ranch Road .. where medical attention is standing by to provide you with relief for your discomfort .. follow all instructions of the FBI agents in the Bradleys .. follow all instructions as they are provided to you promptly and thoroughly .. you are under arrest .. this stand-off is over .. this matter will be resolved .. [movement noise] resolved as

quickly and professionally as possible .. we are not here to inflict any injury on any individual .. come out now in an orderly fashion and no on may be injured .. you are all under arrest .. [movement noise] .. this stand-off is over .. come out and you will be treated professionally .. this is not an assault .. do not fire any weapons .. w have no intention of entering your compound at this time .. this is not an assault .. do not fire any weapons on any of the vehicles or individuals outside your compound .. we do not want anyone else hurt .. submit to the proper authorities submit now .. gas will continue to be delivered until everyone is out of the building .. this is not a negotiable position .. gas will continue to be delivered until everyone is out of the building .. this action has been brought about by your inaction .. and we intend to follow through with this course of action until everyone is safely removed from the building ... exit the compound now .. do not subject yourself and your children to any more discomfort [movement noise] .. place the white flag outside of the door to indicate your readiness to exit .. the sooner you do this the sooner you'll be able to receive relief .. from any discomfort which you have endured from the gas .. if you're not feeling it now I guarantee soon you will be

13.35

RBF is extremely dangerous procedure right now it is not clear when the Davidians who have broken negotiations with FBI .. FBI broke off negotiations repeatedly with the Davidians who have failed tonow .. I know why they've the Davidians and a situation ... away I understand .. are in no hurry .. a very serious situation and everybodyis trying to get them to break it off

RBM ... and the same time you mentioned that

[Movement noise and background speech]

14.56

UM ... the gas mask .. do you need any help

UM Take it off

RBM ... that Koresh was a traitor and another one said that ...everybody made the necessary preparation .. I would say that what's going on now is ... operating this morning er so for many days prior ... overwhelmingthis is definitely er [footsteps] .. been in detention for

16.07

UM Sir

UM Hi continue working on it .. thank you

[Background speech]

16.23

UM You need ...

UM Huh

16.27

UM She's out of her mind

[Movement noise & background speech]

16.38

RBM Believed them detained

UM Another one to take across

UM Have you done it

UM Don't know

UM Even more

UM (Greg) .. this is crap

UM The rope

UM Its always ...

UM Hm

UM Just talk .. talk about it all the time and (run it past)

UM Hmm mm

[Movement noise]

17.23

UM And your Ok

```
[Electronic feedback sound & background noise]
18.17
[Movement noise and unspecified sound]
18.39
[Background speech]
19.29
[Footsteps & movement noise]
UM
      She's got mine
[Background speech & movement noise]
20.22
[Footsteps]
21.01
[Vehicle sounds]
21.16
[Movement noise]
22.43
[Background speech]
23.51
UM
      How did they get out
UM
      Must have crawled through
24.00
UM
      How do we find out
UM
      I don't know
UM
       .. have a good try .....
UM
       You see that's the way that we (block) it .. I don't know about tear gas but you
      know ....
[Movement noise & background speech]
25.26
UM
       You Ok in there
```

[Movement & Background noise] 25.41 UM Can you .. you spare that .. that radio set UM UM Are you playing that CD one .. the stereo one UM We're running out out of [Movement & background speech] 27.50 [Unspecified sound] UM ... list of the frequencies [Unspecified sound] 27.56 [Background speech & movement noise] 29.48 UM Going high UM Nope .. we are just holding on to this 29.57 UM I tried to take them off the phone .. over all of them but [Movement noise] 30.22 UM You wanna get that UM I guess we are not gonna leave then UM Huh uh .. we need to UM Where's that .. its not in the (tray) 30.46 [Unspecified sound] 31.30 UM When did I do that UM I'm not sure ...

31.38 [Unspecified sound] UM What's that UM UM So what's that noise UM Tear gas UF Tear gas [Footsteps & movement noise] 32.06 UM I'm feeling real sick [unspecified sound] 32.33 [Background speech & vehicle noise] 33.39 UM I'm not quite sure what that was all about 33.44 UM UM Still on your side UM Yeah [Background speech & movement noise] 35.24 [Vehicle noise] 35.45 [Vehicle noise] 35.20 UM Ready 36.02 UM Now there's one right here in front .. be ready .. just be ready UM

UM Is it ... UM No UM 36.22 [Movement & background noise] 36.38 [unspecified sound] [Background speech] 36.43 UM Ok 37.27 [Background speech] 37.59 UM You know what they are going to do UM What 38.19 [Footsteps] UM Ok .. what do you want to do UM What can we do UM Give it to the kids UM It's getting so we hardly can breathe in here UM Hey .. its alright UM What they could drive it through there UM That will knock the whole lot of wall ... UM That will UM I don't know 39.15 [Movement noise]

[Distant speech]

39.39

UM Might hold them there

[Movement noise]

[Background noise and movement]

43.55

UM ... I got a real bad feeling again

[Distant speech & movement noise]

47.19

[End of tape recording]

Transcript

Lab ref: 00053/CMM/11

Tape ref: Enhanced copy of 73 Day 2 Tape 4

Key:

.. Natural pause

.... Indecipherable

() Sounds like

[] Descriptive text

- Continuation of speech

0.00 Cassette run time in minutes and seconds

D David Koresh

S Stephen Schneider

BS Byron Sage

UM Unknown male

UF Unknown female

C Child

RBM Radio Broadcast Male

RBF Radio Broadcast Female

0.07 [Background noise & distant voices] 3.26 [Movement & distant speech] 3.40 [Sound source changes] 3.44 UM What's happening boys .. do you hear we're leaving man UM Yeah UM What's going on Steve UM Steve come here UM Yo UM Look around .. everything's okay still UM Yeah UM No mention of anything being observed or UM Okay so that'll be like looking right into the (walls) right UM Steve 4.02 UM Except for the (Daley) no UM That's what I am saying .. it's real good UM Say it is worship time now by the way .. Louis .. Louis .. it is worship time now UM We ain't got time to worship UM I think that's er for the worshipper after this [Background speech] 4.43 UM Thank you [Movement noise]

04.48 UM So you guys Ok now UM Hm [Movement noise] 5.07 UM Still dead UM Yeah [Movement noise & background speech] UM Where you go to is when 5.22 [Coughing sound] UM Yep 6.15 [Movement noise] 7.20 [Movement noise & footsteps] 07.23 Is anybody up at that window .. by the stairs UM UM Dunno .. can't see UM There's someone out there 8.09 [Vehicle noise] 8.20 [Movement noise & background speech] 9.52 [Vehicle noise] 10.01 [Background speech]

10.35

[Unspecified sound and movement noise] 10.52 UM Better move the banner .. so bring down the banner Um Ok move it [Movement noise] 11.13 UM Ok has anybody got the banner from here UM No UM I thought you was gonna move it [Movement noise & background speech] UM I can move it 11.28 UM I'll have the fuel over here for the 11.30 [Distinct tapping sound] [Background speech] UM That's what I was told to do UM Yeah .. this is what they talking about on the damn phone to em 11.50 UM I told em we're getting ready use the phone UM So the banner's going out there .. things are really good for going there .. going there .. sort that one 12.14 UM Keep an eye on these ... UM/F UM Well UM You know them holes are just helping it come in 12.24 UM Well I think

UM Everything seems UM/F in a while you know 12.33 [Movement noise] UM Don't do that to that UM You gonna check my fair enough UM Now the banner is out there .. no way to see it but er they punching another hole here I tell yeah .. and found a hole UM We could fill the holes back up can't we UM No .. they've done it anyway cos we UM The thing they have at the top of stairs UM They are not supposed to make the UM It's the 13.04 UF/M Stop UM Also all the -UF/M UM - they can shine through UM Hey man .. if anything happens .. if we go on with everything .. remember we had a (lot) .. something we can't imagine 13.23 UM cos I had to say that is behind you [Movement & background speech] UM ... probably getting ready [Movement noise & background speech] UM I hope you never thought of that UM May the Lord and may it give you UF/M I dunno UM we can do it

[Movement noise]

14.09

BS - David .. Steven those of you in the Branch Davidian compound we will continue to be delivering gas .. once again this is not an assault .. we are not entering your compound at this time .. this is not an assault .. do not fire on the vehicles or agents around the compound .. if you fire .. fire will be returned .. do not shoot .. this is not an assault .. the ... you smell is non-lethal tear gas

UM Yeah

BS - ... will temporarily render the building uninhabitable .. we have received your message on the banner that you want to have the phone repaired at this time .. the proper resolution to this matter is the safe and orderly exit .. we've spoken for fifty days .. it is time now to exit the building .. and we will treat you in a professional and humane fashion .. due to (hostile) fire we will pull back the tanks from the compound [vehicle noise] .. you are requested to exit the compound at this time in an orderly fashion [vehicle noise]

15.50

UM Whoa

15.52

[Movement noise & unspecified sounds]

16.15

UM Go up and see the damage .. are they getting through

16.27

[Vehicle noise & loud contact noise]

17.06

[Vehicle noise - very close]

[Movement noise]

17.32

UM I actually can't see the damage

[Vehicle noise - very close] 17.40 Ok now .. boy we're Ok UM 18.20 [Vehicle noise - very close] 19.15 UM You better put yourselves into place [Movement noise] 19.05 UM They could go through UM That's what they fear UM They mean to take this [Movement noise] 19.15 [Background speech] UM Ok UM Hey wait up 19.21 [Background speech & movement noise] UM They keep flying over the didn't even take [Background speech & Movement noise] 19.52 [Unspecified sounds] 20.12 [Background speech & movement noise] 21.39 [Unspecified sound] UM Hey Pablo these two guys have almost UM Yeah

UM These here .. this can move to we'll take it up from there

UM Who's talking to me .. who's talking

[Background speech]

22.01

[Unspecified sound]

22.07

UM Is there any word yet

[Movement noise & background speech]

UM ... you all right

UM Oh I'm doing great man

UM Going on (bro's)

UM I don't see any other way man

UM That's cool

[Background speech]

22.41

UM Oh man .. turn around

UM (Thirty years)

23.00

[Background speech]

23.15

UM Where's my gun man

[Unspecified sound]

23.32

[Movement noise]

23.36

UM Ok we

[Background speech]

23.55

[Movement noise & vehicle noise]

24.04 UM Oh thank you .. they gave us some air UM Another wait for more air UM Huh UM We'll full (circle) 24.34 [Vehicle noise] 24.47 UM Well the fact is I don't really know what's happening UM Hm UM I really want to know what's happening man UM Oh yeah 24.55 [Background speech] 25.17 [Movement noise] 25.38 UM They got two cans of (Coleman's) fuel right there UM Huh UM **Empty** UM All of it UM Think so UM Can you check UM There isn't anything showing .. nothing left UM Out of both cans UM I got this (going) on air UM You want some mineral oil UM Don't know .. I'll have to think

Hm

UM

UM I got some mineral oil UM Don't think I got any 26.01 UM There's no UM Hey .. come back here UM Put that UM You're not supposed to steal he's mask by the way UM Really UM What UM You shouldn't go stealing things UM Why .. there's nothing ... you know UM Okay I'll give you one .. want it UM No not .. not yet Ok [Movement noise and background speech] 26.41 UM Who went and took a mask .. we're not a mask [Movement noise & background speech] 27.11 UM Hm UM Yeah might as well hm mm [Movement noise] 27.48 UM God .. Steve you 27.52 [Movement noise and background speech] 28.03 UM You know .. fill up the UM Tin can's behind you

28.26

UM Don't let him steal the masks

UM Ok

UM Not here

UM ... it won't even happen

UM Go the other way .. go the other way if you want to get out

UM I can't get out there

[Movement noise]

28.58

C Dad .. dad

UM Who are you looking for

C Dad

UM Go the other way

C Too many people

UM Huh

C There's too many people

UM We can't ... people the other way

C There's too many people

UM Go the other way

29.23

C There's too many people in the way

UM Too many people

UM Well tell them to get out of the way

UM Can't get through

UM You can't come through here

C There's other people

UM No keep out of the way

UM You know we said

UM No I'm sorry

C I hey

29.55 UM Well tell ya .. when they go down I'm moving away from the children UM We'll move the children [Background speech & Movement noise] 30.16 UM Which one of them is that one UM Are you upstairs UM Is this the way down UM Yeah David says not too many at all UM What did David say UM Move all the children [Background speech] 30.45 UM But they came in there .. you know no we're not ... 31.02 UM I'm gonna go find him UM What do you reckon on 31.26 UM There's a break ... UM We need to tell em right now UM No .. when David say's get them round here .. hello UF/M Excuse me UM Damn UM That's the phone line ... right there but she's out [Background speech] 31.50 UM Where's that [Background speech]

32.10

```
[Movement noise]
32.17
UM
       Where's .. where's the er
UM
       David
UM
       Phone line ..... Right
UM
       The phone will not work you know that
UF/M Right we gonna be ....
32.39
[Movement noise]
33.00
[Continuous movement noise & background speech]
34.24
UM
       We move these ... as well .. yeah mind the .... yeah wire it together .....
[Movement noise & background speech]
35.17
[Vehicle noise]
35.38
[Footsteps upstairs]
36.17
[Footsteps & movement noise]
38.26
[Background speech]
38.17
BS
       - ... .. David er this is Byron Sage
BS
       The .... of the commander has just advised that you are authorised to send one
       person out unarmed to attempt to recover the telephone which you discarded
       earlier this morning .. you are authorised to send one person outside unarmed
       to recover the telephone device which you discarded earlier this morning .. be
```

advised the sole purpose for recovering this telephonic device will be to co-

ordinate the safe and orderly exit of ... from the compound .. with that understanding you are authorised to send one person out unarmed to recover the telephone device which you had sent or discarded previously this morning .. the understanding being that the purpose for re-establishing the communication with the negotiators will be to co-ordinate the safe and orderly exit of all occupants from inside the Branch Davidian compound

[Background speech]

40.38

UM You can't go that way through here I think

[Movement noise & background speech]

40.42

UM He's given up anyway so who knows

41.17

[Movement noise]

41.37

UM Er Pablo .. can you grab the phone and just show them that the line is broken

UM Where

UM Just kind of hold it out but don't have any er don't have any guns on you .. take everything off and just show em the phone line's broke

UM What this one the black one

UM Whatever's broken on it

UM Which telephone .. the black one

UM I guess so .. just show em that the phone line is er broken

42.08

UM I was told you were sitting down inside here

UM Told you what

[Background speech]

42.21

[Movement noise]

UM Give him the ... UM Hmm UM Would you mind taking it off .. hold it right there 42.51 [Movement noise] UM find it UM Do you see a broken line there [Movement noise] UM Take the white cord out .. alright UM Hey (Joe) .. just show em .. go like that .. that's good UM Pablo take that take that little sign off UM I can't see where it's broke 43.24 UM But it is .. here just just show them the line like you just show it's broken UM the whole time UM It's broken .. the cord UM Is that why it's broken BS - right we understand the wire is broken UM Can you see it's broken .. okay UM Oh look you can see it where it's broken UM No UM I could never find it right at this time UM Someone UM How could you tell We have done here before UM UM Can't tell where UM Did they say one person out now UM He wants one more to go out there

Steve can I .. can you take that

UM

UM Ok one person

UM One person

UM Yeah (Ray) and (Dave) go out then

UM One from from the pole underneath a junction box to that thing .. that s all

UM Oh that's where the line goes on

UM You can back into the junction box

UM No it it joined there here .. joins right here

UM In fact the box is still there

UM Right now

UM But this cord might be broken underneath

UM Yes ...I told them it's broken presumed they ...

UM Did you say it's broken

UM Yeah they just answered me do you understand

UM What is he saying

BS We understand from you .. that is broke

UM It must be broken

44.54

UM I cannot I cannot recover it .. cos of the stuff

UM You can pull it across the board

UM Huh huh

UM You can take the ... cord out of the back of the phone .. reconnect it there ..

listen .. let them know

UM The phones right on the floor there

UM You know what I could do

45.08

UM Pablo .. who's talking to you

UM Oh

UM The phone could be faulty .. it could be broken under that wall

UM Hey Steve

UM You've got the junction box there .. I can re-join back into the junction box cos we can plug the phone in .. wind it back in

[Movement noise]

UM How many .. how many lines do I have to connect try to reel that in

45.36

[Movement noise]

45.36

UM As if you

UM Pull it from this end and it came around thesaying cos they started to ...

UM And they were no about 6 o'clock before they even started driving .. the first Bradley had pulled up when it er

45.54

[Movement noise]

UM Pull it on up hang on

BS - David ... er this is Byron Sage .. be advised that er .. we received your message that the phone line appears to be cut .. we want you to retrieve as much of the er cord and the device back into the building as you can to see if it's repairable .. let us know if it appears to be repairable .. give us a signal .. if it is not er they're exploring avenues as to whether or not we have another phone which we can provide to you .. once again I stress to you that the only purpose for re-establishing that contact .. is going to be the co-ordination of a rapid and orderly extraction of all people from inside the compound .. we will ask you to retrieve the wire and instrument back into the compound and Graham or whoever er right here to see if it's repairable .. and give us some sort of a message .. the primary message that we're delivering to you is that it's time to exit the compound and exit now

[End of recording on side A]

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Side B of Tape 73 Day 2 - Tape 4
00.07
UM
      No one was in
UM
       And why did they say that .. because it's so simple to ... you both could (die)
UM
       Both could ....
00.20
[Background speech]
UM
      Graham
UM
       Yeah
UM
      Can you do that then .. but don't have a mask on
UM
      Don't wear a mask for that
UM
      Cos we need to say one last thing to them ...
[Movement noise]
0.38
UM
      Go Graham
UM
       This is what you do .. you take the ...
[Movement noise]
UM
       ... left Graham
      I don't know
UM
UM
       Wave your arms in the air so they can always see ya
UM
       Yeah don't really know yet
[Background speech]
1.02
UM
      Graham
[Movement noise]
01.26
[Background speech]
[Movement noise]
```

01.25 UM ... there they are [Movement noise] 1.28 UM Ok UM They're waiting for you now .. right Ok 01.31 UM I'd like to know if the other's have gone up through [Movement noise] 1.48 UM Dave UM Hello [Background noise] 02.13 UM Try him on his (head) [Movement noise] 2.06 UM They have moved UM I heard that [Background speech] UM ... not looking to bad now .. Ok [Movement noise] UM We're ready (Jeff) 2.26 UM Can you keep reporting to me the progress .. if there's any at all about er er hard line UM What UM About getting a line going UM Where are you are you

UM The line's dead UM -out right there UM I'll be upstairs by David UM The lines are dead 2.39 UM Yeah I know it is .. I figured it would be cos they cut it themselves UM Yeah UM First thing that happened wasn't it UM It is UM I could throw the line out .. see if they could repair it 2.53 [Background speech] UM Do we give a sign that it's dead UM The wire's been (broke) UM All wires .. but you know what it is .. already anyway UM Well they asked to check again as far as I'm (concerned) [Movement noise] UM Well just kinda listen to what their announcement is always .. so I think they already know don't they UM I made them as clear as that -UM Yeah exactly man-UM - and they UM -and they acknowledged it so 3.18 UM It's broken UM Before they ask again they just wanted to check again UM Okay just respond accordingly because we do want to get a line to say at least something to 'em UM Ok you want to

3.24

UM We've asked that we could finish the seven seals .. hear the manuscript .. the first one was about completed it was worked at all last night .. but there's no way that you know I gotta be able to say that to 'em but not you know

3.35

UM Want me to let em know that the line is cut at that spot

UM Yeah see .. Pablo already knows that but he's just went out already to ...-

UM Oh okay

UM -still working on it

UM What do you think Graham

UM It's definitely out ...

UM Yeah he sent Graham .. Graham will do whatever

[Movement noise and change in noise level]

UM Better not (Scott)

UM Hey hey hey .. hey

BS - Only one person can come outside ..grab the wire and bring it back in the house

4.14

UM Bring that back

UM No what they're saying they probably got another one

UM Grab that one too

4.20

UM Be very careful Graham .. look around ya

BS - Inside of the compound .. one person may come outside take the wire back inside the house

4.31

UM Inside

UM Yeah just grab hold of the line and bring it back in like we have before but be very careful watch around ya .. see where they're at

```
[Movement noise]
5.15
UM
       (Hold on)
UM
      Boy talk about contamination huh
UM
       Yeah you can say it's big time
[Movement noise]
[Background speech]
5.36
UM
       We will get another piece of line to you if necessary
[Movement noise]
5.51
UM
       They can they get another line too em
UM
       Yeah
UM
       Alright pull him in .. starting to .. is there any more in here ...
[Movement noise]
UM
       Okay I'll report it back upstairs
UM
       There you go
6.04
UM
       Oh man
UM
       Yes
UM
       I can't hear you
UM
      Oh .. oh
[Movement noise]
6.18
UM
       Hey bro .. first will give you ..... this time you do what you can Ok .. volunteer
       to you know
[Background speech]
6.27
UM
      Have you seen him
```

```
UM
       No nothing
BS
       - Stephen
UM
BS
       - David er go and bring that er wire back into the compound area .. er where
       we're are checking to see if er that line is not working er just give you another
[Background speech]
UM
       What
6.46
BS
                recover as much of the telephone line as you can back into the
       compound and we will attempt to see if there's another er telephone device to
       er .. get through to you-
UM
       Yeah .. just put that out of the window
UM
       ... you know that could be a problem man
BS
       - help restore re-establishing communication if possible .. will only be to co-
       ordinate a rapid response and exit of individuals from inside the compound ...
       go ahead and recover as much of the telephone line as you can at this time .....
       recovery
UM
       Go ahead and keep .... down
UM
       I feel a little .....
[Background speech]
7.45
UM
       See.. we'll only have it in
[Movement noise & background speech]
8.08
UM
       Take charge
[Background speech]
8.20
UM
       At least the man .... I'm glad that ....you know that's a reason ....
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```
[Movement noise]
UM
       I beg you not to do it
[Background speech]
8.52
UM
       May God be merciful ....
UM
       The Lord knows the way rightful .. may ...
[Movement noise]
9.10
[Background speech]
9.16
[Movement noise]
[Background speech]
9.48
UM
       Is this yours
UM
       .... doubtless praying for you .. the bottom line is ....
9.57
UM
       The wire's coming in ...
[Movement noise]
10.10
[Someone blows their nose]
[Background speech]
UM
       Sure it's your own then
10.15
UM
       Lord how have they prayed in front of me .. made there .... may they be with
       you day and night Lord and there's no help for them to ...
[Change in sound level]
[10.33]
[Change in sound level]
10.35
```

UM ... of the Lord .. God you have already God always ... I have spoken to you God .. so patience is a word our Lord takes note hear from my followers ... have mercy upon me and hear my prayers good men .. how well I know that you ... how well I know do you love man I know the words down there is pride in my heart .. I will use those words ... Oh Lord please hear my words Oh Lord .. and hear my meditation My saviour .. my God to you I pray .. the voice you shall now hear in the morning Oh Lord is the morning where I direct this prayer I beseech that you do not take ... now is not exactly the We shall ... thou keepest your followers ... thou shall destroy them I implore you Lord I hope you hear my worship Meet me oh Lord .. in my rightful ... and mine enemy make them Make them go away .. for there is no reason whatsoever Destroy them Oh God .. they can follow there own counsel .. pass it on to .. they have rebelled against me .. but all those .. will be destroyed .. let them And the ones that want thy name destroyed within me .. thou won't ... the fight .. they without compassion you can chain me .. in my hot flesh .. have mercy me oh Lord for I am meek .. Oh Lord kill me .. in my moment of death my soul is off the floor and thou oh Lord .. how long .. how long Lord .. deliver my soul .. Oh save me for my mercy sake .. in that knowing Pray we shall not bend ... I am hearing that they will And the water may go to my kids .. my eyes and my heart will ... Oh Lord hear ...

[Movement noise]

14.26

BS - (David Steven) .. we want you to out of the building .. calm and controlled .. do not fire your weapons if you fire fire will be returned

UM See if we've got

BS - Do not ... this is not an assault .. the gas you smell is a non lethal tear gas .. the gas will temporarily render the building uninhabitable .. eventually the tear

gas will work its way into your water .. your clothing and your food .. exit the compound now .. the time for talk is over .. exit the compound

UM It will go into the water and the building

The exit evacuation plan will be the same as we have discussed throughout the stand off .. you are not to have anyone in the tower .. the tower is off limits .. no-one is to be in the tower .. movement observed in the tower will be considered as act of aggression and will be dealt with accordingly .. you and only you are responsible for your own actions .. if you come out now you won't be harmed .. follow all instructions come out with your hands up .. carry nothing .. come out of the building and walk up the driveway towards Double E Ranch Road .. medical attention will be provided to relieve any discomfort .. follow the instructions of the FBI agents in the Bradley vehicles .. this standoff is over it is time to move on .. continue with this at a better location at a better time .. come out and you'll be treated professionally .. we do not want anyone to be hurt .. this is not an assault. .. gas will continue to be delivered until everyone comes out of that building .. the time to exit is now .. this is not .. notice we do not want you stay in that building .. the time to exit is now

16.52

[Movement noise]

19.30

UM You guys gonna get us some water

UM Yeah we have some here

UM If you want to take a drink if you want to go ahead its Ok

17.26

[Footsteps]

UM If you wanted to take a drink of water if you want to

UM

UM Put it right here

UM Yeah

UM We're gonna do a job .. we need to drink [Movement noise] 17.53 [Background speech & movement noise] 18.53 UM/F They could turn round and 18.56 UM/F Do you want to go find David and let him see it [Movement noise] UM I'm thinking of going to the UM Is David around UM No he went up the other way .. the only way is to go up through there and see him UM I reckon he won't [Movement noise] 19.36 [Movement noise] [Background noise & movement noise] 23.43 [Background noise & movement noise] [27.49] [Vehicle noise] 28.22 UM Remember if the those break .. let me tell you something .. they will break this door The fumes are there already UM[Movement noise] 28.35 [Movement noise]

31.24

[Footsteps & movement noise]

32.55

[Vehicle noise]

UM They're moving something

33.02

BS - .. this is er Byron Sage .. we are continuing to place tear gas into the building and will continue until the last person is removed hopefully safely and unarmed .. this is not an assault .. we have no intention of entering the building at this time .. this is not an assault .. so do not fire any of your weapons .. if you fire we'll .. the fire will be returned .. do not shoot this is not an assault .. the gas that you have been exposed to and will continue to be exposed to is a non lethal tear gas .. the gas will temporarily render the building ... uninhabitable .. it will also eventually permeate your water .. food and clothing .. you need to realise that this stand off is over .. it is now time to exit the compound in an orderly fashion .. David .. Stephen we have discussed on numerous occasions the exact and safe evacuation plan .. that same plan is in effect now .. you will exit the compound by coming out the front of the building .. turning immediately to the left and proceeding down the driveway towards Double E Ranch Road .. the medical facilities are already staged and ready to assist you upon your exit .. the transportation is already here and ready to ferry you all for appropriate processing and to expedite your appearance before the magistrate .. the time is now David it's time to come out of the compound .. I'm sure if the fact is you have concerns for your followers you stressed the fact .. that you are still working on the seven seals .. you demonstrate your concern for your followers .. we will demonstrate our ability to allow you to work on the seven seals on the time of your release .. the instructions remain in tact regarding the tower .. the tower is off limits .. noone is to get in the tower .. any movement in the tower will be considered an

act of aggression and will be dealt with accordingly .. David .. Stephen .. Wayne .. all of you remaining inside the compound you are responsible for your own actions .. it is time to exercise that responsibility and lead those people out of the compound safely and securely at this time .. if you come out now you will not be harmed .. follow all the instructions as they were provided to you by the FBI agents .. come out of the compound with your hands up .. carry nothing with you .. have nothing on your person which will appear to be a weapon .. come out of the building and walk up the driveway .. towards Double E Ranch Road and medical attention will be provided to relieve you of your discomfort from the gas .. follow the instructions specifically as they're provided to you by FBI agents .. which will meet you in the Bradleys .. follow these instructions and we will not have any further difficulty with relation to the safe resolution of this matter .. this stand off David is over .. the delay is over .. it is time to move forward and get this matter resolved .. we've been here for over fifty days and we'll not be here any longer .. come out and you'll be treated professionally .. I personally assure you of this .. we do not want anyone to be hurt .. follow these instructions and there will be no further injuries and no further need to expose yourself and the children to any more discomfort [37.17] .. this is not an assault .. it has not been an assault .. do not fire any weapons in relation to on-going activities .. we do not want anyone to be hurt .. it is time David to submit to the proper authorities .. gas will continue to be delivered until each and everyone of you are out of the building .. this is not a negotiable area .. gas will continue to be delivered until each and everyone of you has exited the building .. exit the compound now .. we stand ready to receive you .. to provide you with the medical care that you need .. provide you with the transportation and the legal representation .. I'm sure you're listening to the radio .. there is a significant amount of attention .. your concerns are going getting your message out as is your intention .. we do not stand in the way of facilitating that for you we've told you that for fifty days ...

it's time to come out .. it's time to come out now .. place white flag out of either side of the front door to indicate your readiness to exit .. lets get this moving lets get it moving now

UM/F We can't handle this

38.54

UM Are we supposed to open the tape or .. I dunno

[Movement noise]

39.08

[Background speech]

UM ... we are used to that

UM What

UM When we leaving

UM Today alright

UM Ok

39.20

[Background speech]

39.40

UM We'll be still

40.00

[Movement noise]

UM Wait for it anytime .. we don't know what's

[Background speech]

40.30

UM Makes sense to put you out there man

40.37

[Movement noise]

UM Well wait outside .. he might come and get you .. they've started the gas again

UM Oh great

40.45

{Background noise & background speech]

41.40

[Background speech]

42.20

UM Follow Graham .. he's going up

[Movement noise]

[Background speech & Radio broadcast]

UM Boy we need some water

44.14

UM ... in trouble again

UM Can't strain it

UM I don't want to use it

45.22

[Movement noise]

[Radio broadcast in background]

45.54

[Movement noise]

[End of Side B Tape 73 - 4]

Transcript

Lab ref: 00053/CMM/12

Tape ref: Enhanced copy of 73 Day 2 Tape 5

Key:

.. Natural pause

.... Indecipherable

() Sounds like

[] Descriptive text

- Continuation of speech

0.00 Cassette run time in minutes and seconds

D David Koresh

S Stephen Schneider

BS Byron Sage

UM Unknown male

UF Unknown female

C Child

RBM Radio Broadcast Male

RBF Radio Broadcast Female

0.06

BS - come out and be treated professionally .. no-one will be injured .. do not ... do not subject yourself to any discomfort .. [movement noise] come out now .. today's action does not mean that the action taken today was we believe the next logical step in a series of actions to bring this episode to a conclusion

[Vehicle noise]

0.55

BS - the action today was -

[Vehicle noise]

- after we arranged the contact they .. they slammed down the phone and I believe they actually threw the phone out the door er we asked that the phone line be restored .. but once the phone .. on the TV show before I came here .. they were ... at the compound we told them to try and reconnect the previous phone line to see if it's functional .. we have not made any contact with that equipment yet

UM What about the injuries at this point

UM Er any report of injuries .. we have no reports of injuries on the inside of the compound as yet

UF ... go to talk about going to continue to gas

UM Er me .. that is the plan today .. erm we will continue to gas probably all day .. the information we have is that those inside the compound er have tear gas masks available to them in fact we believe that every adult has a gas mask we will continue to put the gas in the same way as we have already .. make it as uncomfortable as possible to get these people to leave the compound

UF continue to gas until all of them walk out the compound

UM The question we ought to ask is we do not know if they have gas masks as well

.. but we've gone through every angle that's possible to ensure that the

cartridges being utilised are well below medium to lethal ranges of tear gas .. we would not use dosages that would harm those children .. nor would those dosages cause damage to their lungs or other types of injury .. there doesn't no sense in talking about that if tear gas were utilised it would cause the children ... what we are using is not the type of tear gas which we would which we are using .. we're using a non toxic type of tear gas which is not so it is not a lethal type gas yet by a long yet

UF do you think the will come right out

UM The question is what anything tell you .. ah yes

UM But we've seen you pounding at the compound .. you see er people gas .. the question is will you continue to pound the compound

UM The the pounding of the compound that you see is really a necessary function of er of the insertion of gas .. we have a ... delivery system they're attached to those CV's .. we will put those through into there each time those (grooves) are placed into there .. you cannot see it on the picture .. but we're looking at fifteen seconds .. fifteen different blasts of gas each time .. that gas is dispersed over a fifty-five foot area .. it is not necessarily at this point one of destruction to the compound .. at this point we are we are gassing and will continue to gas

4.58

UM Is there some reason that you went in through that front door .. did you advise them at any time to be careful that this is an area you're coming in and ... that room

UM Actually all we advised them at that time was that we were right in the front door er we have gone in and covered almost the entire premises with gas at this point .. we are not advising them at any time .. we are continuing to anyway to er advise them to please exit the compound please leave they will be treated professionally and they will not be harmed .. they can leave at any time .. that's it

UF ... anywhere ... been injured .. if they are waving their hands they could possibly be coming out

UM Nope

F It seems regardless of what injuries you are going injured first

UM The question is er we don't know what ... (Mr Kleiner) er as of yesterday he had not even saying that he's responsible for ending it .. and also we advised that they they considered the the .. the meeting with the attorney was being involved a stalling tactic as the attorney did er .. not only go along with that but they have asked if they are coming out .. it's ...

UF After seven weeks .. what was it that made you decide this is the morning we're going to go and do this now

Er the question is what made us decide to do it now .. we believe this as you can see if we look around the compound here we have slowly taken away everything around the compound .. if you saw a picture of that .. fifty one days ago you would have seen that we had vehicles all what you have here right now is yesterday we had to clear away this area of the wall .. we have slowly put the pressure upon them to come out .. each step of the way we have announced what we were doing .. we have given them various ultimatums .. we are going to continue to press and press until they come out .. they have resisted at each step of the way this was cleared out we advised them yesterday .. again they did not react .. we are now at what we believe is the next logical juncture of putting sufficient pressure on them to cause them to come out .. we're using non-lethal means .. we are not assaulting the place we have no FBI agents go in the compound .. even though we have probably had over two hundred round of ammunition fired at us we have not fired back

UM What

UM We're using the ultimate line of restraint and we're bringing pressure to make sure they come out .. yes sir

UM Er do you do you or the FBI take the point now that they might have a possibility of suicide

UM Um the question is one we have of course we possibly we ... the compound ... all obviously we're aware of the pressure that's taking place .. is a suicide a possibility .. we thought that this was probably the best way for them to prevent that type of suicide pact from taking place .. that it causes confusion er inside the compound er also we felt that their instincts er them motherly instincts would take place and they would want their children out of that environment it appears they don't care that much about their children which is unfortunate .. we have continually quizzed those coming out and they stated the general rule .. they say suicide they believe is not a possibility they say sir

8.35

UM And one of the first things I had heard with regard to the stories from in the compound was the and certainly we heard it reported later that .. some disagreements within the er law enforcement personnel is actually the plan is not ... how do you explain that

UM Er the question is with regard to

UM Hm

Of the vehicles er what we did was we had .. we had various things that had to be attached er towing mechanisms to these vehicles and they were pulled out .. no way were they destroyed .. this is of a perceived thing .. all of them .. the vehicle .. those vehicles were in fact able to move on their own move

UM This is not good ok .. don't

UM And can you tell us what happened when the banner came out at the compound

UM Er what was with regard to the telephone line .. they came out er again the banner was there we broadcast over the PA system that we had .. er please

come out retrieve the previous phone line that they had thrown out .. attach it back to the phone and see if that will function .. I have not had a report yet as to whether that will function yet

9.43

UF Alright .. sorry (Bob) .. what were the ... coming out yesterday evening after 7 o'clock with can you tell us about that

UM Er yesterday evening in fact .. at er .. after the negotiating (attempt) er which we continued to make a dialogue with them .. er we decided that we should try to and er they asked for a typewriter ribbon so we sent a typewriter ribbon we also gave more milk for the children er so that's what you saw yesterday evening .. give

UF I have another question .. as for knocking (holes) into the side of the building into the actual concrete .. to confine them to smaller and smaller areas of the compound

UM Er the question is would we be trying to put them in a smaller and smaller areas .. All I'd say is we're trying to take away certain portions of the compound from them .. you can't take necessarily smaller and smaller er areas except .. we would like to pinpoint the areas where they might be able to reside yes sir

10.36

UM Obviously ... the building you to avoid this gas .. how long can they last underground if in fact they can go down there in the bottom

UM Er the question is how long can they er last if they did go underground .. we have we have had a number of intelligence reports that they reports that they do have underground tunnelling system .. there's no doubt about that .. er some of those have been greatly exaggerated .. primarily we believe they have crawl space in the area right here they have various which I think most people er know about .. this is also a series of underground tunnels in this area .. we believe many of those now are non-functional .. er many of those areas were

because of the recent rain have been flooded out er information is that they have dumping a lot of their human waste in that er particular area too .. we believe that er probably er crawl space .. underneath the compound .. the gas will permeate those areas as well .. so again it's not we're not anticipating they're all gonna flow out at any second right now but we will continue to apply the pressure .. we'll try to make their living environment as uncomfortable as possible inside

- UM Yes thank you .. er how much er how much more of the gas goes .. if that's the case what sort of involvement would you allow them to have will they remain in contact with their lawyers .. or would you just cut them out if
- UM Er the question is what the the only involvement that they will have will be as far as a final settlement .. that offer has always been there .. if they agree to a final surrender er and they needed their attorney there that still might be negotiated .. at this point we're not negotiating .. we're saying come out .. come out with your hands up .. this matter is over .. yes
- UM The er gas .. is it confined to specific areas or what ... or effect that gas has on the
- UM Er the gas the gas-
- UM [Overlaps with above] ...
- um -applies a number of irritants to the nostrils to the eyes to the skin does something to the skin will be extremely painful .. er it is non-lethal but it [Movement noise] ... extreme discomfort .. again er will cause nausea .. er you can have a certain type of inflammation with regard to the membrane er so it is extremely uncomfortable .. they do have gas masks so er .. a substantial majority of the substance at this point they're able to protect against .. against the follow up
- UM Are you knocking down walls or are you somehow yourself or ...

UM Ok .. er the point of the strategy which is important is to make sure people ... gas is delivered .. in some cases we were battering entering in through a window in other cases we were trying to reach hallways and other er-

UM

UM -areas where we can possibly disperse the gas involved .. yes mam

UF How many times did you batter the building today

UM The question how many times did we batter the building .. I because I left to come here at ten o'clock the best estimate that I have was eleven to twelve times .. I can't tell you precisely I wish I could because I don't know exactly what has transpired in the interim .. er but I cannot give you er the ... the amount of gas has been put in there .. but it has been quite substantial yes sir

UM Have you Going through the walls

UM Er the question is er am I surprised er I am not surprised .. I think you have a totally fanatical committed group to David Koresh .. er we believe that there's a hard core group .. they're all heavily armed .. they're all firing at our vehicles when they do appear .. er those [other speech] we .. we believe that they're surrounded with firearms and probably are not being allowed to leave .. er those that are totally loyal to Koresh er to have to require extreme discomfort we believe and probably a signal for Mr Koresh that now is the time to get out of here .. yes sir

UM we are er you

14.41

UM Well I can't show you all the the .. literally surrounded er this morning at approximately six o'clock .. five minutes after I called Mr Schneider we had our (CV) in position .. the first place we entered was here on this side of the building which is er basically on the er westerly side of the building .. we turned around and we came back and we also punched a hole in here .. and gas ... insertion .. if during the day though we have been making insertions all the way round the compound the last one was right through the front door ..

this door you see this door ... was heavily barricaded .. they have been preparing for an assault for a long time they just they just barricaded throughout the tower .. they've been they've been putting a we believe .. enforcement they have building the whole time today

UM What's your understanding of the integrity of the building .. do you intend to knock .. to se if you ...

18.54

UM The question is what about the actual integrity of the building .. we believe it is poorly constructed .. if we wanted to er knock the building down we probably could do it in less than a hour .. and in fact if we do not-

UM [Overlap with UM above] Is that from outside or

-there's just a massive strength by that (CV) .. that is er that is an extremely ...

type of vehicle er all you're seeing that they demonstrated is actually the power

of the boom your not seeing the power that can be demonstrated by the vehicle

itself .. yes

UM Then follow up .. is there a plan perhaps to knock down the building

UM Is there a plan to knock out the building .. as far as I know there's no plan in effect at this point to knock down the building yes sir

16.16

UM Er you mentioned that you had had intelligence to say that .. they were they were not planning to come out at all .. where did you get that intelligence that intelligence .. intelligence that they were ...

UM The question is where did they tell the came out .. again I cannot discuss tactics nor can I discuss intelligence

UM Aaah

UM Ah yes sir

UM Did the FBI work for the ...

UM Er the question is did the FBI er Janet Reno order this to let us proceed er again my function has been and has been along with three other commanders ..

er that plan was presented back to the Department of Justice er through our operations centre and my understanding is that she was fully in accord with the with the plan erm yes sir

17.00

UM How long do you think they can gas masks are do you know if that

UM The question is what is the life of the tear gas mask .. the problem that we have is er .. it appears that they have a hodge podge of different masks .. er we've had very various descriptions regarding those masks .. some of those we believe have a life of up to (eight/eighty) hours .. others may provide them with so there's a lot of er [movement noise]..... informed the

UM Do you know whether the gas leeks to the bottom of in the underground areas where you put it

UM The question have we put in gas in the bunkers that we ... yes we did .. all we had to do is apprise them of the use of that and that we would stay away from the building .. yes sir

UM Could the confirm how Mr Merrill is

UM Er is Mr Merrill we all-

[Noise – Laughter?]

UM - is still in good shape he was very concerned about er yesterday in fact that was probably er the most violent .. most reactive in the fifty two days ...

UM

UM Fifty two

UM ...

UM Fifty one days that we've been here

[Voices overlap - inaudible]

UM (phones) ... in the area

BS - we are not entering the building .. do not fire your weapons if you fire .. fire will be returned

UM so

```
BS
       - Do not shoot .. this is not an assault
UM
       [Overlap with above] .... full of gas ..... (weapon) ....
BS
       - the gas you smell is a non-lethal tear gas .. however it will temporarily
       render the building uninhabitable .. the gas will eventually permeate your
       clothes ... exit the compound now ......
UM
       [Overlap with above] ... today
BS
       - .... follow
UM
       [Overlap with above] Look at what .....
BS
       - .... (fire) .....
[Overlap of UM and BS – inaudible]
BS
       - around the compound building
UM
       So we can all have .....
BS
       - ... you are not to have anyone in the tower .. the tower is off limits-
UM
       Er .....
BS
       -- ..... now .... after the ....
[Overlap of speech]
BS
       - .....
[Overlap of speech – inaudible]
19.31
BS
       - ... put up your weapons and ..... come out now .. (weapons) .....
UM
       There's at least er .... the building
[Overlap of speech]
19.42
[Vehicle noise]
BS
       - ... what you ... now is a non-lethal tear gas it will temporarily render the
       . . . . .
[Movement noise]
UM
       The building is being evacuated
BS
       - .... gas ....
```

```
UM
       Can you turn the radio ....
BS
UM
       Tear gas-
BS
UM
       - we strongly believe to be Koresh's ...
BS
       - exit the compound ....
UM
20.19
[Movement noise]
UM
       Yeah
BS
       - .... now or .... comes from .... everyone come out of the building exit ....
UM
       Everyone is .... the building
BS
       - .... yourself ... children those .....-
UM
       .... tear gas has even ....
[Overlap of speech]
20.53
BS
       - .... the compound (here) ..... (the door)
[Overlap of speech]
UM
       .... I don't think they want ..... again er they have to reaffirm that the tear
       gas is ....
21.12
[Movement noise]
UM
       Erm again I want I want to emphasise erm that this is not an assault by FBI
       agents.. this is an assault on the compound using tear gas we are not
       encouraging anybody of our agents individually to fire on you .. the agents
       have received fire .. the agents have received fire that fire has been directed at
       the BV and other vehicles
UM
       . . . . . .
UM
       Yes sir
```

UF Um shortly after you began knocking holes .. what

21.51

[Movement noise]

UM Er we went up -

[Movement noise]

UM - through the front door and (break) so forth had there been without going at the ...

UF And er ... contain everything ...

UM out there er and we believe at first that we had a white flag that was being waved inside .. they were directed and in fact to wave a white flag to come out and to surrender .. the surrender never did occur thank you

[Music]

22.27

RK Hi this is Ron Kay and I want to share a thought with you about prizes (dollars in)

22.40

[Movement noise]

UM Okay er President Clinton commenting on today's activities Janet Reno the attorney general they have said that they do not .. they don't want any more blood shed and fortunately it never got the four of the agents have died and I believe another fifteen or more were wounded .. I understand that one of the ... have said [movement noise] er lets go back out to er ... and then for our Network coverage gets here and-

23.48

UM Don't you feel a little embarrassed

23.52

[Movement noise]

[Radio program in background]

[Movement noise]

25.05

[Movement noise]

[Radio program in background]

25.55

.... And what I see is and what I believe is the beginning of the end er of a er a non-violent end .. I believe that Koresh and will have to come out of there .. I think that er .. I think what's really disheartening about it all really is er erm .. I think there's a power play here and er unfortunately religion er is kinda at the fore .. forefront for all this because what it's saying is that that these people are not erm even though these people are not just (secretive) they think that er the er ... though ... they when all this started back when the erm Branch Davidian's er had a news conference and saying that er they indeed had felt like their beginning of the end was transpiring as it did-

UM Hm hm

UM - loss of credibility so as far as the Branch Davidian belief er for this has been ... they all going for years and years and years .. and they never heard not one single person who they er

UM Well yes that's absolutely right I think what you're talking about is er 19 er 35 that the Branch Davidian er talking near Waco

27.25

[Movement noise]

UM Well yes I think pretty (mad) ...

UM Yes ... I think that they they also so you know this isn't the first time .. er that that all they were .. on it you know the ATF illegal weapons

27.53

UM Well I've talked to you about this before and I'm gonna say it again .. you never hear not one time that the ATF has gone into Los Angeles where all the gangs ... were stored up arms or in New York when the (Bloods) and the

was nailing each other and had some kid here and there not one time did ... hear that er gang members .. arms .. where it would have put them into danger .. now they are going into these religious groups and I'm really curious as to who were involved there erm people who amassed a large number of guns and one of them is supposedly a tank

UM Well that's all conjecture nobody knows that

28.39

UM What I am saying though is they got things in

UM We are gonna carry on material ...

UM We don't get what we put in a (eight eight) what one would cost so automatically the press thinks they they've amassed a couple of tanks .. got em sta' got em hidden in some bunker up there .. but those people they all they want to do is there is er they .. have a already .. they study the bible they get sick on (crap) and what they believe in the end really don't matter .. they stand up there and it maybe that er some ... people don't er normally deal with but it's and the (city's) tanks I guarantee you (at six million) ... that'll be a tank yes with those pregnant women and those children in there to me is just ludicrous .. I don't know how the hell you should get me out but it seems to me like what we're seeing here is the beginning of what's gonna end this conflict is ...

30.00

UM Not only is it for the Branch Davidians but er .. er what they're were doing

here just put that on a one to basis what's gonna happen to all of us ..

sooner or later this I mean this is going to be another of those things

UM What if those ... come on and won't do it you're trying to they call this shallow

UM But you see there's really is like people exactly like you said that er (gal) up there was worried she just wants to come on down and guru and work ...

UM Guru .. guru them all

```
UM
       Guru them all yeah
UM
       Yeah
UM
       She's going to .... er .. you can't predict ... erm .... herself ... pull off the ....
30.44
[Movement noise]
UM
       Most of all of these end of the world believers .. they preach the same thing as
[Vehicle noise]
31.03
UM
       I know that .....
31.16
UM
       ... underground
UM
       Er they're vulnerable to a ATF ... same as the FBI .. this place
[Vehicle noise]
UM
       - already lost three people in the storm ......
[Vehicle noise]
UM
       And ... that that one with the big boom on it we .... the area according to the
       FBI was in charge of this whole thing and the ATF was stood down that's
       what it seems to me that he was saying er according to .... so didn't really
       know why .. so I don't know what to tell you
32.03
UM
       Well I'm really just erm this is ...... they talk about ... here .. they talk about
       three thousand eight hundred dollars worth of taxes that haven't been paid ...
       but they don't mention the one (down) but hundreds .... puts me an ..... right
       now .. they ... this story for another part of it .. they going to ..... the worlds
```

not gonna hear it and er

Doesn't matter

32.35

UM

73 Day 2 - Tape 5

UM I don't remember who I was talking with but er I was talking with was a

Branch Davidian or a former Branch Davidian who said that they would pay

over hundred thousand dollars

UM Yeah that would do it .. hell man that was over before they even moved the (complex)

UM Yeah and they had to pay that back

UM They didn't

32.45

UM If I was David .. you heard that guy on the building at the news briefing .. he said er it's poorly structured so which you know compound that just you know shot a hole in that er well that they that they told that in

UM You know just like the Andy Weaver thing there's no bulletproof areas in there that I know .. er and if you take a look at those er BV's go in there then they're punching holes right through that rather like those

UM You know I was surprised to hear that er the Davidians shot at em this morning .. they felt that they had sort of solidified a non violent ... when they allowed the ATF to go in and get their wounded out .. really now I don't know whether to believe all that or whether there's something we're just not being told

33.40

UM Just remember one thing Jerry the only point of view that there is .. is that of the FBI cos that's the side the FBI want us to hear .. now if the FBI isn't going to tell you that they fired back they're just going to play the good guys now they were fired upon and didn't return fire now .. well we'll just have to wait er er I'm not gonna say to you

34.05

UM That's what I think about it they should have gone and talked to em

UM Well that's why I feel a bit .. after ... with a certain amount of scepticism because .. there's just no way that .. stupid enough to realise that basically if

you fire a weapon into a tank er a rifle into a tank it won't pierce the armour that's not gonna happen

UM Right

UM That's just not going to happen and David isn't so stupid as to not realise that so why would he want to waste his ammunition .. you know .. you have to ask questions .. you gotta be serious to ask questions

34.40

UM Well I know .. I'll let someone else get on the last but er I'm just a little disheartened about this whole thing

UM So am I Jerry thank you-

UM You are [chuckles]

UM - Carol Carol Hill hi Carol

UF How you doing

UM Good how are you

UM get out of the car people over here go park the cars

35.00

UM Er ... are painting a very one sided picture on this thing

UM Well we're just trying to paint the other side of the picture the only side of the picture we've ever heard looks like it's given to us by the FB .. the FBI

UM Yes but I thought seems to be er mentioned here

UM What's that

Is the fact that I don't care who's right and who's wrong and every one else ...

I guess that right or wrong .. these people in the compound know exactly who's outside .. all they gotta do .. they know the whole world is watching .. all they gotta do is come outside and the (ATV) is going for ... in fact the is not ATF erm er anybody who threatens to break the law er is subject to er er .. being the law should decide hey we're going out and they say well I ain't going out

UM So where are the (daughters)

UM er the one guy is being more er ...nothing against Koresh or anybody but erm they are being the er they are in and erm er their word er and they can't hide for

36.19

UM No one else

[Movement noise]

UM Hey do you want ... or what

UM Who's going around

UM I have no idea

UM

[Radio program & speech overlaps]

BS - Now er get this thing moving forward er we have ... we are not leaving ..
until all of you safely removed from that compound and we'll continue to push
tear gas into the building as necessary to bring you out -

UM The issue is

- this is not an assault .. and never has been .. what we're attempting to do is introduce a non-lethal gas .. to extract you from inside the compound .. we are not entering the building .. but we will continue to er .. press this issue to insure that each and every one of you will eventually be forced to exit the compound .. do not fire any weapons .. we have erm confirm reports that several have fired at any agents .. we have not returned fire ... but if we think our agents are in jeopardy erm you will be fired upon .. do not shoot .. this is not an assault .. the gas you smell that will quite obvious to you it is a non-lethal tear gas

37.50

UM whatever

[Radio broadcast continues in the background]

BS - The gas is non-lethal and will temporarily render the building uninhabitable .. it will eventually permeate your water and food supply .. the tear gas is

discomforting as far as exposure to your skin and it will not improve until such time as you get proper medical treatment right now of the tear gas .. you need to exit the compound at this time and follow the instructions that have been provided to you .. by exiting the compound you exit the front of the building turn to your left and proceed down the driveway towards Double E Ranch Road .. then the medical attention will be provided to you

UM You often hear that .. it's been right from the beginning

BS - immediately upon reaching this area .. the right medical capability standing by and we are ready to furnish those to you as we have promised throughout the last fifty days

UM Yo Edward

UM Edward

UM Don't let em (rile) ya

38.50

BS - once again there's to be no-one in the tower the tower is off limits

UM Did you see this .. hey

BS - there's to be no-one in that area with firearms

UM Sure .. is David here

UM Yeah .. he's saying we should hold the fort

BS - anyone observed in the tower will be considered an act of aggression and will be dealt with accordingly

UM Hello David

SB - David each and every one of you must realise that you are personally responsible for your own actions .. that's been true from the very first day .. it is true today .. come out now and no one will be harmed .. come out with your hands up carrying nothing .. don't have anything on your person which would appear to be a firearm .. explosives or any other erm possible hazardous device

39.33

UM I think we're three to four

BS - come out of the building and walk up the driveway towards Double E Ranch
Road .. medical attention is waiting for you at this time .. follow instructions
provided to you specifically by the FBI agents in the Bradley vehicles

39.51

UM Ok

UM If I I got there .. there's always putting it down

BS - We are not entering the building .. we intend to do this as easily as possible.. but what .. we do is in large part your response

UM Get started on it ...

BS ... your part of the promises have been false .. your word has been hollow .. it is time to come off this position which ... the whole Davidian compound .. the individuals inside the compound can leave at any time .. the time is now

40.23

UM can't see what's going on

- we don't want anyone injured .. we want you to exit now and submit yourself to the proper authorities .. gas will continue to be applied .. gas will continue to be delivered .. er til each and every person is out of the compound .. do not continue .. do not continue to (expose) your children to any more discomfort .. the decision is yours and solely yours .. you claim to be a leader .. you claim to be the prophet you claim to be the Messiah .. the time is to leave is now

41.05

UM But David listens to this show every day

UM Huh huh

UM But let me tell you this er .. David er I know this isn't what you want to hear ..
er but I think it's time that you know you got er your children in there
[Movement noise] now with all of this tear gas is going in there .. the FBI is
drawing up ... until this point there's been nothing but lights and awful lot of
loud noise coming through there all day and all night long .. er now they're
inside there with tear gas er according to the Press briefing at some point ..

and er David why don't you all just come out now and er for him and his followers to come out and to allow themselves to be arrested and to David to be able to tell their side of the story because if this continues the way it's going right now we will never hear the other side of the story .. the only side of the story we'll ever hear is the side that the Government wants us to hear .. and the only chance that you have David er is for us to hear your side of the story is to get the children get your women get your men and .. leave your weapons in there .. er and you Wayne Martin er .. and Steve Schneider and everyone else er come out you can write your manuscript just as easily from a jail cell as you can inside the compound .. and ultimately no more conflict inside the ... you are inside the complex .. but you must know that you are able to have

[Movement noise]

42.37

[Vehicle noise and movement noise]

Ives and have no more pain upon those that you love the thing you gotta do is come out now er .. beyond that is a very dangerous thing for you to do .. but I think it's the only way that we can assure that that you will be alive to tell us your side of the story .. make them so you come out of there right now because without a doubt the FBI is not going to stop this .. got more and more and more .. right now they're using tear gas they may use pepper gases .. I guarantee you if pepper gas is used they'll be able to walk in and you'll be on the ground .. you'll suffocate you won't be able to move .. don't let that happen .. don't let that happen to your loved ones David and you're looking out for your children .. very few people coming out of the compound

[Vehicle noise]

43.55

- that's the only path .. that's the only thing you can do er is get you want to hear you can win .. get him to quit it's just going to get worse and worse from

this point and I honestly don't .. genuinely know what they are going through right this minute .. inside that compound .. David .. I don't see any other way .. I don't see any other way I don't want to see anybody die .. I want to see everyone go out of there

```
[Vehicle noise]
47.30
UM
       ... in trouble there .. ...
[Vehicle noise]
44.57
[Background speech]
UM
       .... well all these kids to the Bradley's
UM
       Whoa
[Background speech & vehicle noise]
45.16
UM
       Sure your thinking their probably right outside the door .. ready for (action)
       right
45.21
[Background speech]
UM
       Ain't been there for twelve years .. never gonna hold em .....
UM
       Get me a ...
UM
       Always break the ....
UM
       ... to them
[Background speech & noise]
UM
       Staying here is the right way for all of you ....
45.50
UM
       .. before .... right
UM
       We hadn't .....
[Background radio & noise]
46.06
```

UM Bet he's thinking forty years

UM What .. I can't hear ya

UF/M Why did you move everything

UM Ok

UF ... sure all the details are out in the open

UM where are they gonna catch

[Radio broadcast & movement noise]

[Movement noise]

[End of recording on side A]

Side B of Tape 73 Day 2 - Tape 5

[Background speech & Broadcast]

00.27

UM Ok and is he's up in his room now

[Radio/TV broadcast in background]

[Movement and background noise]

00.57

[Background noise and broadcast continues]

2.01

UM Get all the people

UM All the people

UM All of em

[Movement noise & broadcast continues]

2.44

[Movement noise]

2.50

UM ... we've got

[Movement noise & broadcast continues]

3.25

UM Gone to get em

UM Putting on a prayer

UM ... how's it going

UM What

UM

UM A what

UM The last thing for ...

UM

UM You can get out

UM I'm not going out .. break that out UM Wait UM Do you want to break it UM Not gonna do it like [Movement noise & broadcast continues] 3.45 [Radio broadcast continues in background] UM Come down here [Movement noise & broadcast continues] 3.49 UM A lot lower .. they can still see you UM Go low .. cause you're a bit too high [Movement noise & broadcast continues] 4.00 [Movement noise & broadcast continues] 4.07 UM We're ready [Movement noise & broadcast continues] 4.25 UM Go ahead.... UF where do you this UM 4.34 UM Lisa UF Yeah [Movement noise & broadcast continues] [Background speech] 4.40

Yeah they are getting it through it

UF

```
UM
      Can't .....
[Movement noise & broadcast continues]
5.00
UF
       (Greg) got it
UM
UM
       Sure he got the man ...
5.02
[Background speech]
5.06
       They might come in ... they (poke) the wall and it come straight through to
UM
      here
5.09
UM
       Can't we throw it back
[Movement noise & broadcast continues]
5.14
UM
       All you got to do is ......
[Movement noise & broadcast continues]
5.25
UM
       Ok we're done here
UM
       Sure
[Movement noise & broadcast continues]
5.50
[Vehicle noise]
[Movement noise & broadcast continues]
7.11
[Movement noise & broadcast continues]
7.26
UM
       We'll have to move the children cause they ....
[Movement noise & broadcast continues]
```

```
7.42
BS
       - .... we are now placing tear gas and er .. are ..... and will not...... if you
       wanna come out .. you must come out now until no one is left in the compound
[Movement noise & broadcast continues]
8.15
UM
       And they still want to play games
UM
       There isn't any reason to go out there
UM
       No
BS
       - ... of the compound .... if you fire .. fire will be returned
[Movement noise & broadcast continues]
[Vehicle noise]
8.35
BS
       - not come out .. the gas will temporarily render the building uninhabitable ..
       surrender all weapons .. and exit the compound now .. ... follow the
       instructions ..... exit the ....... outside the ...... exit the compound now
       ...... right on towards the Double E Ranch Road where a flag ..... medical
       attention will be provided .....
[Vehicle noise]
9.52
UM
       Do you think I could light this soon
9.57
UM
       They're gonna go right through the middle here
[Vehicle noise]
10.12
       - ..... no longer ....
BS
[Background noise]
SG
       - ... the compound ....
[Movement noise]
```

```
10.36
UM
       Whoa .. whoa
UM
       Whoa
UM
       We should have ...
SG
       - the tower is off limits .. no one is to be in the tower -
[Movement noise]
10.51
UM
       . . . .
UM
       I'm right here
UM
       (Lie down)
UM
       I hope you've already .... you know
UM
       The fumes are already getting in ....
11.09
UM
       It not getting better
11.18
       - ... you have all the assurances ...
BS
UM
       ... give me the bottle of water .. I'm gonna need it
UM
       I need the water first
11.22
BS
       - .... over the ......come out into .... er ......
11.39
[Change in noise level]
11.42
[Change in noise level]
11.44
       - come out with your hands up .....
BS
UM
       Some in here
11.56
[Movement noise]
```

```
11.58
UM
       Get out .. get out .. no they've already (moved)
BS
        to prevent further injury ...... come out and .... to the proper authorities
       ...... those inside are free to leave at any time ...... one of the ......
[Movement noise]
[Vehicle noise]
12.14
UM
       Lets go .. let's go .. move .. they're ....
BS
       ..... think about your children ... exit the compound now ...
[Movement noise]
12.40
[Background speech]
UM
       .... move
UM
       Didn't take long
BS
       - ... at this time ...... children not to get .....
13.00
[Background noise]
BS
       - come out to prevent further injuries .. come out .. proper authorities now .. do
       not subject yourself ... those inside are free to leave at any time .. we need to
       resolve it now ...
13.17
[Vehicle noise]
UM
       . . . . .
[Movement noise]
13.50
UM
UM
       I can't hear you
UM
       Look on that for ....
UM
```

UM What can I do for you UM What If you need a place to worship UM [Movement noise and background noise] 15.00 [Movement noise] [Vehicle noise] 15.30 UM They must have dragged [Movement noise] 15.41 UM ... do that UM Just move the other one [Movement noise] 16.00 [Background speech] [Movement noise & broadcast speech] 17.19 UF ... told us [Vehicle noise] 17.56 [Movement noise] [Vehicle noise] UM I think we should move UM No good moving em around you know UM I've not got the 18.12 [Broadcast & background noise] 18.31

```
[Movement noise]
18.36
UM
UM
       No .. no .. it's alright ......
[Background speech and vehicle noise]
19.12
UM
       Got to remember those big (windows) ...
UM
       . . . . . . .
UM
       Won't do any good though if we can't ....
19.19
UM
       What is that
[Movement noise & background speech]
19.34
       Look .. those are real .. real solid
UM
UM/F Don't ....
[Background speech & broadcast continues]
19.45
UM
       Figure they might have ....
UM
       ..... can't put it on the roof .. definite
[Movement noise]
19.54
UM
       I wonder if they can now
UM
       It can ... it's easier
[Broadcast & background noise]
20.00
[Background speech]
UM
       If they do .. you know ....
UM
UM
       You gave them food .. yes
```

```
UF
       Yes
UM
       They'll .. they'll want leave for sure .. you know what I'm saying
UM
       They can't do anything right now
UM
       Here's that stuff (but I can't) put it .......
UM
       I'm lucky that ....
UM
       ..... Athena
[Background speech]
UM
       Well there's two stories they've ......
UM
       Thank God .....
[Movement noise]
20.27
UM
       .... You guys .. there's one .. one to aim at .. right across .. one across right
[Movement noise]
20.48
UM
       They're inside they're starting right now .....
[Background speech & movement noise]
21.04
UM
       Look .. let's give em a real .... in here
[Vehicle noise]
21.17
[Background speech]
21.51
[Movement noise]
22.24
[Vehicle noise]
22.27
UM
       God .. another one
UM
       Do you want me ... it's ....
```

22.37 UM Right here .. look out [Vehicle noise] UM Whoa UM Great .. don't even move 22.49 That vehicle UM [Background speech] 22.53 UM Look at it move [Movement noise] 23.07 UM Come on .. come on .. move here 23.18 [Movement noise] UM/F Oh God 23.24 [Unspecified sound] UM Way to go 23.27 [Unspecified sound] UM Tell em we're gonna move 23.58 [Vehicle noise] [Background speech] UM They've moved the vehicle UM Stop UM We really want that If they really gonna move then we're committed UM

```
UM
       Can't move his leg
24.41
UM
       Can't even be asked to move it
UM
       Steven saying ..... Piercing a hole right through the roof
[Movement noise]
25.11
UM
       We're near the point where we oughta be er ....
UM
       We've no .... we're not to blame for that .. we're not to blame ....
UM
       Looks to me that you gotta .....
UM
       You'll have to deal with that
[Background speech & movement noise]
26.03
[Vehicle noise & movement noise]
26.22
UM
       Go and get the kids
26.42
[Vehicle noise]
UM
       They'll go for the barn
[Movement noise]
[Background speech]
27.05
UM
       I wanta fire on the front .. you two can go ...
[Background speech]
27.26
UM
       You don't need to go out there
[Movement noise]
[Broadcast in background]
28.22
UM
       Hey (bro's) you got your ....
```

```
[Movement noise]
28.32
UM
       They'll be back ....
[Movement noise & background speech]
30.00
UM
       Pull him in
UM
       Oh oh
30.28
UM
       Gas what do you think it is
30.48
[Background Broadcast]
UM
        .... running around and the person who ..... from the FBI I don't know how
       .. nobody will talk to me so ..... not involved in the ....
[Background noise & movement]
31.56
UM
       David .. David
[Movement noise & background speech]
BS
       - David we are in a position to administer ..... -
UM
       More ....
BS
       - n we are prepared to stay here as long as it takes for you to come out of there
       ... we are prepared to continue ... tear gas .. we do not want to have to do that
       .. come forward and show a sign right now .. put out a flag out the front door ..
       ... and we will not .... the gas .. if you do not respond at this time the gas will
       be disseminated ... do not fire any weapons .. do not take any hostile action
       against the .... who are administering the gas .. the gas will smell but itself is
       non -lethal .... right now ... people .. outside with the flag out of the front
       door and we will make the vehicle stand back and allow these people to exit
32.14
```

73 Day 2 - Tape 5 Page 36

[Movement noise]

```
[Background noise & vehicle noise]
34.20
BS
       - back off and facilitate the safe and orderly exit right now .. you know the
       results of the gas .. it will render the building uninhabitable for a period of
       time
UM
       He ain't in here
BS
       - .. wave a white flag out the front
UM
       He's gone
34.59
[Movement noise]
BS
       -.. evacuate the building right now .. right now .. and ..... -
[Movement noise]
35.54
[Vehicle noise]
[Movement noise]
BS
       - .. come out in an orderly fashion .. ...
[Movement noise]
[Vehicle noise]
37.22
UM
       Stay down .. they just threw it in there
37.28
UM
       ..... people may be hurt yeah
[Movement noise]
37.36
UM
       Keep low
[Background speech]
[Vehicle noise & background noise]
UM
UM
       Keep that fire going .. keep it
```

[Movement noise]

38.10

[Transmission noise - signal loss]

40.31

Recorder OFF

End of Side B 73 Day 2 -Tape 5

Transcript

Lab ref: 00053/AV

Tape ref: Enhanced copy of Audio Track from FLIR Q1 [05:58 - 08:00]

Tape reference CMM/1 & CMM/2

Key:

.. Natural pause

.... Indecipherable

() Sounds like

[] Descriptive text

- Continuation of speech

ST Sierra-TOC

S-1 Sierra 1

S-2 Sierra 2

S-3 Sierra 3

S-H Sierra Hotel

H-1 Hotel-1

D-1 Dallas-1

C-T Charlie TOC

C-1 Charlie 1

E-1 Echo 1

G-1 Golf 1

* M Unidentified male

* F Unidentified female

AWO Automated Weather Observation

MMA McGregor Municipal Airport

WA Waco Approach

05:58:19 [Video commences]

AWO Two eight .. altimeter two niner six niner

* M Spotter

* M Ok

05:58:29

MMA McGregor Municipal Airport

05:58:31

AWO Automated Weather Observation

05:58:32

* M There's a big cloud right where it's not

wanted

05:58:33

AWO One zero five seven Zulu .. sky conditions

ceiling one thousand seven hundred broken ..

visibility one zero .. temperature six four ..

dew point five five .. wind .. one eight zero

at two one peak gusts .. two eight .. altimeter

two nine six nine

05:59:07

MMA McGregor Municipal Airport

05:59:10

AWO Automated Weather Observation .. one zero

five eight Zulu .. sky conditions ceiling one

thousand seven hundred broken .. visibility

one zero .. temperature six four .. (dew)

point five five .. wind one eight zero at two

three .. peak gusts.. two eight .. altimeter two

nine six eight

[05:59:43]

M I'll try to reach... [Radio noise] M [in background] There's the cloud ..damn 05:59:45 F Can't see it 05:59:46 MMA McGregor Municipal Airport 05:59:48 AWO Automated Weather Observation one zero five nine Zulu .. sky conditions ceiling one thousand seven hundred broken .. visibility one zero .. temperature six four .. dew point five four .. wind .. one eight zero at two three .. peak gusts two eight .. altimeter two nine six nine 06:00:20 M Ah no hope .. it's clear on my left side 06:00:25 MMA McGregor Municipal Airport 06:00:27 AWO Automated Weather Observation .. one zero five nine Zulu .. sky conditions ceiling one thousand seven hundred broken .. visibility one zero .. temperature six four dew point five four .. wind .. one eight zero at two three .. peak gusts two eight .. altimeter 06:00:55 S-1 Sierra 1 Sierra-TOC we have observer bravo one

		[Radio noise]
06:01:01		
	M	10-4
06:01:03		
	MMA	McGregor Municipal Airport
06:01:06		
	AWO	Automated Weather Observation one one
		zero zero Zulu
06:01:11		
*	M	6 o'clock
06:01:12		
	AWO	Sky conditions ceiling one thousand nine
		hundred broken visibility one zero
		temperature six four
06:01:20		
*	M	Er Sierra-1 we're buried
06:01:22		
	AWO	(Dew) point five four wind one eight
		zero at two zero peak gusts two eight
		altimeter two niner six niner
		[Radio noise]
06:01:42		
	MMA	McGregor Municipal Airport
06:01:44		
	AWO	Automated Weather Observation one one
		zero one Zulu
06:01:50		
*	M	Any sign of em down there

AWO Sky condition ceiling one thousand nine

hundred broken

06:01:55

Er the um clouds have not broken -

AWO Visibility one zero

M - and er

06:01:58

AWO Temperature six four

* I can't even tell where the borders are .. I

can-

AWO (Dew) point five five

* M -see the

AWO Wind

* Ights but er I can't see-

AWO One eight zero-

* M all the way's ahead

AWO -at

* M So

AWO -Two zero

06:02:08

* M We're over it

AWO Peak gusts

* M few of the er .. around

AWO Two eight .. altimeter .. two niner six niner

[Radio noise]

06:02:21

MMA McGregor Municipal Airport

06:02:23

	AWO	Automated Weather Observation one one
		zero one Zulu sky conditions ceiling one
		thousand nine hundred broken visibility
		one zero temperature six four
06:02:39		
*	M	Wait I think -
	AWO	Due point five five
*	M	-I see it that's it right there
06:02:42	M	That's it right there
*	F	[shouts] See that little break there
*	M	Yeah
	AWO	One eight zero
06:02:44		
*	M	That's it we're over there Ike
06:02:45		
*	M	Yeah
	AWO	Two zero peak gusts
06:02:48		
*	M	There we go
	AWO	Two eight
06:02:49		
*	M	Did you see it
*	M	Yeah I I lost it again so I don't know
	AWO	Altimeter
06:02:51		
*	M	Just keep an eye on that spot I think we'll
		know
	AWO	Two nine six nine
*	M	Ahh

M Your not allowed to lose it 06:02:55] F [Chuckles] 06:02:56 M That's two .. two miles 06:03:00 MMA McGregor Municipal Airport 06:03:02 AWO Automated Weather Observation .. one one zero two Zulu .. sky conditions ceiling one thousand niner hundred broken .. visibility one zero .. temperature six four .. (dew) point five five .. wind one eight zero at two four .. peak gusts two eight .. altimeter two niner six niner [Radio noise] 06:03:38 MMA McGregor Municipal -06:03:40 M I got it MMA - Airport 06:03:41 **AWO** Automated Weather Observation one -06:03:43 M I got it .. I got it now **AWO** - one zero three Zulu .. sky conditions ceiling one thousand nine hundred broken .. visibility one zero-

06:03:53

M Oh right 06:03:54 F That's it AWO - temperature-M Can't be sure AWO -six four .. (dew) point five five .. wind .. one-06:04:01 M Tape on AWO - eight zero * M Yep AWO Two two ... peak gusts 06:04:05 M Audio's on AWO -two eight 06:04:07 F Yep everything's on AWO Altimeter 06:04:08 M Thanks .. backing away from the door here AWO -two nine six nine 06:04:12 Sierra-1 .. Sierra TOC we have an observer S-1 Charlie one 06:04:18 MMA McGregor Municipal Airport 06:04:20 AWO **Automated Weather Observation** 06:04:22

M AWO -one one zero three M -hold on .. in there AWO -Zulu .. sky conditions ceiling one thousand-06:04:28 S-TOC Er Sierra TOC unit calling er -AWO -nine hundred ... S-TOC -state your designator and er-AWO -one one zero S-TOC -what side of the compound AWO -temperature six four dew point five five 06:04:35 S-1 Sierra-1 .. Sierra TOC Charlie one White side **AWO** - wind 06:04:39 S-TOC 10-4 **AWO** - one eight zero at two two .. peak gusts two eight .. altimeter two niner six niner 06:04:56 MMA McGregor Municipal Airport 06:04:58 **AWO** Automated Weather Observation .. one one zero four Zulu .. sky conditions ceiling one thousand niner hundred broken .. visibility one zero 06:05:11

Hold niner five ok

- temperature six four

M

AWO

0	6	•	N	١5	•	1	1
v	v	٠.	v	J	•	1	т

M There's a big er -

AWO - (dew) point five five

* - cloud covers part of it

AWO - wind .. one eight zero (S) two zero peak

gusts two eight .. altimeter two niner six

niner six

06.05:27

S-2 Sierra-2 to TOC's Observer at Black Bravo

Six

MMA McGregor Municipal Airport

AWO Automated Weather Observation

06.05:36

S-1 Sierra-1 to Sierra TOC compromise .. Sierra-

1 .. Sierra TOC compromise

AWO One one zero five-

M All right there is some action

AWO -Zulu .. sky conditions ceiling one thousand

niner hundred broken .. visibility .. one zero

* M Er give me a hole come on

AWO -temperature six four .. (dew) point five five

wind one eight zero at two zero peak gusts ..

two eight

* M That's affirmative compromise compromise

AWO -two niner six .. niner

MMA McGregor Municipal Airport

AWO Automated Weather Observation-

* Being light right

AWO -one one zero five zulu

M -Yeah see it's er .. they've broken down there AWO -sky conditions ceiling one thousand M There's your road coming in AWO -nine hundred broken M There's a little nine and er AWO -visibility one M -five AWO -one zero temperature M Nine and six AWO -six four .. dew point five five .. wind Oh I got it M AWO -one eight F .. it's about there AWO -zero (S) .. two zero peak gusts M It's gonna .. your gonna lose it AWO -two 06.06:43 S-1 Sierra-1 .. Sierra-TOC the vehicle-AWO -eight .. altimeter S-1 -the tank is taking fire AWO -two M -he's taken hits I can see the rounds bouncing off of him MMA McGregor Municipal Airport M Went under cloud AWO Automated Weather Observation .. one one zero six Zulu .. sky conditions ceiling one thousand nine hundred broken .. visibility

one zero .. temperature six four .. dew point five five .. wind .. one eight zero S two zero peak gusts .. two eight altimeter two niner six niner

[Radio click]

MMA McGregor Municipal Airport

AWO Automated Weather Observation .. one one

zero six Zulu .. sky conditions ceiling one

thousand niner hundred broken .. visibility

one zero .. temperature six four .. (dew)

point five five .. wind one eight zero [radio

click] two zero .. peak gusts two eight ..

altimeter [radio click] .. two niner six niner

[radio click]

MMA McGregor Municipal Airport

AWO Automated Weather Observation

* M Go back in five

* You got it

AWO -one one zero seven Zulu .. sky conditions

ceiling one thousand nine hundred broken

M Oh thick cloud .. damn oh man

AWO -visibility one zero

k M [Sighs]

AWO -temperature six four .. (dew) point five five

wind .. one eight zero at

[radio click]

* Er we gotta break coming up .. that hole on

the top yeah

06.08:46

	S-1	Sierra-1 Sierra-TOC we have observer
		Delta One
*	M	No thick cover now
*	M	Oh man this is aggravating
	S-2	Sierra-2 TOC observer Black Delta one
*	M	You gonna have a hole coming up
*	M	Al the ceiling's come up to nineteen
		hundred feet still not enough
*	M	All right
*	M	You see it now we got a big one riding
*	M	Yeah
*	M	Heading our way
*	M	Did you see lights at all
*	M	I can see the lights er it's thin but er every
		now and then you disappear
06.10:22		
	S-1	Sierra-1 to Sierra-TOC we have observer at
		Delta One they need to gas that tower
*	M	can we see before this cloud was there
		anything
*	F	Barely
	S-TOC	Sierra-TOC 10-4
*	M	But it's thick all the way to er
*	F	No breaks
*	M	Yeah
		[radio noise]
		[breath into microphone]

	S-TOC	Sierra-TOC to er Sierra-1
	S-1	Sierra-1 go
	S-TOC	We need to know what er window that er
		fire was coming from
	S-1	Oh we can't tell we can hear the shots and
		we can see the rounds bouncing off the tank
	S-TOC	Is there still fire er coming up
	S-1	10-4 we can still hear the rounds hitting off
		the tank
	S-TOC	Roger that
06.12:44		
	S-1	Sierra-1 Sierra-TOC we have observer
		Bravo Twelve
06.13:10		
	S-3	Sierra-3 can confirm that gas went in Red
		Delta One
06.13:16		
	S-2	Sierra-2 we have hits in Delta Bravo and
		Charlie windows
		[Radio noise]
*	M	Er 7 zero to Sierra-1 er keep an eye on Bravo
		fourteen er thought we saw something
		coming from there
*	M	I ain't at er 2
*	M	Before it disappears
*	M	Disappeared
*	M	Come up to 2
		[Radio noise]

*	M	Wait
*	M	Your out
		[Breath into microphone]
*	M	Pretty good hole
06.15:31		
	M	C-Alpha HR-12
06.15:47		
	M	C-Alpha HR-12
*	M	Hole there on the south side want to come
		around er southwest Southeast side er we
		had a hole
*	M	Covering is still one thousand nine hundred
*	M	That's 10-4
06.16:47		
	S-2	This is Sierra-2 we've had no fire from either
		there or here
		there of here
06.16:56		there of here
06.16:56	S-3	Sierra-3 has none
06.16:56	S-3	
06.16:56	S-3 AWO	Sierra-3 has none
06.16:56		Sierra-3 has none [Radio noise]
06.16:56 06.17:03		Sierra-3 has none [Radio noise] Two one eight zero at-
		Sierra-3 has none [Radio noise] Two one eight zero at-
	AWO	Sierra-3 has none [Radio noise] Two one eight zero at- [Radio noise]
	AWO	Sierra-3 has none [Radio noise] Two one eight zero at- [Radio noise] Sierra-1 to Sierra-TOC yeah be advised that

*	M	Right through that hole
*	M	Nah there's not enough
*	M	We're in
*	M	[In background] unit
06.17:31		
	M	You just can't tell
*	M	okay
		[Radio noise]
06.17:41		
	S-1	Sierra-1 to Sierra-TOC er we're assuming it's
		from the windows because we can't see any
		holes coming out of the walls
		[Radio noise]
*	M	Ok your too far back come up about eight
		do you have it
*	M	You got a big hole holding up
06.18:53		
	F-TOC	Forward TOC to HR-12
	F-TOC	Forward TOC to HR-12
*	M	Any chance of getting under this shift
*	M	Say again
*	M	Any chance of getting under it
*	M	What the
*	M	C-Alpha to HR-12
*	M	It's come up a little bit
		[Radio noise]
*	M	C-Alpha to HR-12
		[Breath into microphone]
06.20:00		

	C-Alpha	C-Alpha to HR-12 be advised that we are we
	o rapaw	are in a good position right now if you can
		manoeuvre your vehicle up so it's touching
		ours to form sort of a wedge please do so
		right now
*	M	[Intermittent transmission] 30 thousand
		200 miles my runway 6 six thousand
		to frequency decimal five point
		[Breath into microphone]
		[Radio noise]
*	F	It's a break
*	M	Zero one zero one start at my
*	M	I wondered if you were coming back today
		(Hunter) congratulations
*	F	[Cough]
*	M	Just over one six we have
*	M	One six exit runway one niner be next to
		move up
*	M	One niner zero one five alpha hundred and
		(fifty) to go
06.25:56		
	S-2	Sierra-2 to TOC er I've got a window open
		and an observer in Black Bravo six see
		movement can't see a weapon
		[Breath into microphone]
*	M	It looks too far to the right
*	M	Yeah I think it's where
*	M	Think you're right
		J 00 10 11 <u>6</u> 110

*	M	Okay
	171	[Breath into microphone]
*	M	-
4	M	Lost it again
		[Breath into microphone]
*	M	[Groans]
*	M	Not gonna stay are we
*	M	Yeah you weren't going to make it
*	M	Yeah I can make it
		[Radio noise]
*	M	Still nineteen hundred feet at McGregor
		[Radio noise]
06.29:33		
	S-2	Sierra 2 to TOC just had er movement in
		Black Bravo Four
*	M	Got that
	S-TOC	10-40
06.29:44		
	S-TOC	Sierra-TOC to er Sierra-1 we just had word
		from the Forward-TOC that there may be
		something wrong with the phone line and er
		someone may come to the front door and er
		give a hand signal if they want to er talk
		beware that
	S-1	Sierra-1 copy
06.20.07	5-1	Sicira-1 copy
06.30:07	G 2	
	S-3	Sierra-3 to TOC be advised that we don't
		hear any loudspeaker from Sierra-3 position
		[Radio noise]
06.30:22		

	S-1	Sierra-1 Sierra-TOC that's er affirmative
		on the speakers
		[radio click]
06.30:30		
	S-TOC	Sierra-1 you are or are not hearing the
		speakers
	S-1	We do not hear the speakers
	S-TOC	10-4
06.30:40		
	S-2	Sierra-2 to Sierra-TOC we can hear the er
		speakers on the Sierra-2 position
	S-TOC	10-4 Sierra-2
*	M	Hang onto that there's a hole I'm gonna try
		to stay over
*	M	Сору
06.31:16		
	S-1	Sierra-1 to Sierra-TOC we have a white flag
		out the front door and a hand did come out
	S-TOC	Roger that
*	M	That's
*	M	There's the first one of em
*	M	Nope
*	M	Er it's the cornfield I'm sorry
*	M	Cloud and clear area to the left that's your
		gonna be your hole when I get onto the
		other side
*	M	Got another hole
*	M	Unbelievable

*	M	before
*	M	There's a hole coming up right here
		[Radio noise]
*	M	And that'll be it for a while
*	M	Man it's extensive too I mean it's
		everywhere you look there's nothing but
		cloud cover
*	M/F	Everywhere
*	M	Still one thousand nine hundred feet
*	M	Oh
		[Radio noise]
*	M	We bother wait for
*	M	We're in six hundred you know
06.35:49		
	S-TOC	Sierra-TOC er Sierra-2 do you see a er white
		flag now out of er Black Bravo Seven
06.36:01		
	S-1	Sierra 1 to Sierra-TOC we have an observer
		White Bravo 12
06.36:20		
	S-TOC	Sierra TOC to Sierra-2 er I'm on monitor
		here in the er TOC it looks like we have a
		white flag here out of Black Bravo Seven
		can you confirm that
	S-2	2 to TOC er we cannot confirm that the er
		the water tower the silo is in our line of
		view
06.37:16		
*	M	10-4

06.37:19		
	S-1	Sierra-1 Sierra TOC they just er put a red
		flag out red blanket out the front door
	S-TOC	Copy that
		[Breath into microphone]
*	M	Still holding nineteen hundred feet ten miles
		at McGregor
*	M	Ok
06.39:19		
	S-3	Sierra-3 to TOC
	S-TOC	Go ahead Sierra
	S-3	Red Alpha Two we had a very bright flash
		similar to a er camera flash
	S-TOC	10-4
*	M	Er give me a minute here will you just
		please stop come on
*	F	This is terrible
		[Breath into microphone]
*	M	Sky 4 (WACO) from
*	M	Sky 4
*	M	I copy you Sky 4
*	M	Helicopter Sky 4 are you requesting flight
		our way
*	M	Sky 4 to
*	M	I don't hear you
*	M	Sky 4 is already en route here
*	M	Oh good men forty minutes into the
		operation
*	M	Boy they got it quick didn't they

*	M	(Jim 90) WACO Group
*	M	Sky 4 radar contact now south of
		(Michigan)
*	M	Heard he's gonna take a full week five four
		three seven
*	M	Eighty four thirty's gonna take decimal
		five one seven
*	M	Three nineteen fifteen is the helicopter
		channel that we use down there
*	M	Got it
*	M	I'll set him
*	M	No hang on (Jim)
*	M	Alright hang on a second yeah
*	M	Is that off 4
*	M	No it's on two you gonna pick er (WACO)
		and you do pick up when you talk to them
*	M	Okay
	MMA	Altimeter two nine seven zero
		McGregor Municipal Airport
	AWO	Automated Weather Observation one one
		four three Zulu
		[Radio noise]
*	M	Haven't seen
		[Breath into microphone]
*	M	We have 100 at Macgregor now
*	M	Alright
*	M	Seven seven ninety contact Fort Worth
		Centre one three five point 37

good morning [radio click] * M Seven six for [Breath into microphone] * M Oh they're getting thicker * M Yeah popping up with the heat * M Might be better on television * M Seven seven sixty contact Forth Wort Centre one three five point three seven [Radio noise]	h
* M Seven six for [Breath into microphone] * M Oh they're getting thicker * M Yeah popping up with the heat * M Might be better on television * M Seven seven sixty contact Forth Wort Centre one three five point three seven	:h
[Breath into microphone] * M Oh they're getting thicker * M Yeah popping up with the heat * M Might be better on television * M Seven seven sixty contact Forth Wort Centre one three five point three seven	:h
 * M * Weah popping up with the heat * M * Might be better on television * M * Seven seven sixty contact Forth Worth Centre one three five point three seven 	:h
 * M * Yeah popping up with the heat * M * Might be better on television * M * Seven seven sixty contact Forth Wort * Centre one three five point three seven 	:h
* M Might be better on television * M Seven seven sixty contact Forth Wort Centre one three five point three seven	:h
* M Seven seven sixty contact Forth Wort Centre one three five point three seven	:h
Centre one three five point three seven	h
[Radio noise]	
F1	
[Breath into microphone]	
* I got it off the wing right now about er si	X
down	
06.50:30	
S-1 Sierra-1 to Sierra TOC Bravo Eleven Whit	te
side observer.	
* M Still open alright	
* M No it's er filling in on er on open spots	I
can see the road and one (mirror) and that	's
about it	
06.51:40	
S-TOC Sierra-TOC to er Sierra Units Forward-TO	С
wants to know if er you can see er if thos	se
rounds are being fired right from the window	W
or back from within the rooms	
* M Sky 4 would you like	
S-1 Sierra-1 do not observe any fire	
* M	

06.51:59		
	S-2	This is er 2 to TOC we have no fire on the
		Black side no fire on the Black side
		Sierra-3 we have none on the Red side
06.52:11		
	S-TOC	Sierra-1 are you still hearing rounds from the
		White side
	S-1	Sierra-1 that's negative
06.52:32		
	S-2	Sierra-2 to TOC er there's movement in
		Black Bravo five
	S-TOC	Copy that
06:54:37		
*	M	Er ok
*	M	There's another hole coming up
*	M	Sky 4 you will be within a restricted area
*	M	This is Sky 4 Waco approach
*	M	Sky 4 verify your view with respect to how
		you see us at the airport
06:55:31		
*	M	a er over on thirty five
*	M	Roger
*	M	That information is correct altimeter two
		niner seven zero
06:57:27		
*	M	Come up above er six seven
*	M	Come down to eight erm looks like it's
		covered over
		[Breath into microphone]

		[Microphone contact noise]
06:58:38		
*	M	That's got deep going over there I wonder
		who that could be huh Dave
07:02:17		
*	M	Still twenty one hundred at McGregor
07:05:51		
		[Breath(s) into microphone]
*	M	Sky 4 on radar sir three zero zero point
07:07:56		
*	S-1	Sierra-1 to Sierra-TOC er be advised we do
		not have any ferret rounds we have military
		gas only
*	M	Sky 4 roger I have your report
*	M	Golf Bonanza six zero romeo whiskey
		with you at six thousand
*	M	Sky 4 er how long before you'll be airborne
		again
*	M	Sky 4 that part give me infra red ok
*	M	Command to six zero romeo whiskey Waco
		approach altimeter two niner seven zero
		seeking altitude
*	M	Nine seven zero six romeo whiskey level six
		thousand
		[Radio noise]
*	M	[very feint]Bob you need this one
07:13:29		
	S-1	Sierra-1 Golf-1

07:13:46

0,,12,,10		
	S-1	Sierra-1 er TOC
	S-TOC	Go ahead Sierra-1
	S-1	Yeah you can advise Golf-1 that erm Sierra-
		1 position has They are 79 if they want to
		come back here and pick it up they can have
		it
	S-TOC	Golf 4 TOC is (runway) clear
	Sky 4	Helicopter Sky 4 roger we're on zero three
		six seven and ninety
*	M	Sky 4 radar contact six miles south east of
		Waco airport altimeter two niner seven
*	M	Sky 4 TSTC towers closed no landing
		information available Waco is one eight
		zero at one seven I suggest you are gonna
		land on him
*	M	Roger change at (adviser) frequency one
		three zero zero
*	M	I know we're starting to get breaks that's
		great so it's er
*	M	Waco approach bearing zero four six zero
		hotel bravo eight thousand
*	M	Bearing six six six zero Hotel Waco
		approach altimeter two nine seven one
*	M	Two nine seven one Sierra Hotel
07:19:59		
	S-1	Break break Sierra-1 Sierra TOC we
		have White Tower One open

*	M	Commander (niner four)
	S-TOC	Copy that Sierra-1
	S-1	Er Sierra-1 to Sierra-TOC that's White
		Tower Three correction on that White Tower
		Three
*	M	Affirmative
	S-TOC	10-4
*	M	Roger
*	M	[very faint] Oh man
*	M	Looks like it's breaking up
*	M	Well it's trying to
*	M	Yeah it's trying to break up to the west
*	M	Yeah six Sierra Hotel now cleared to direct
		(temple) inform Victor seventeen at (temple)
		and navigation flight heading one seven zero
		'til receiving you
	S-H	Sierra Hotel roger now heading one seven
		zero will go to direct (temple) will join er
		Victor seventeen at (temple)
		[Breath into microphone]
*	M	Break up [laughs] where yeah right guys
*	M	White goes up to twenty one hundred now I
		think we're finally getting some results here
07:23:12		
*	M	10-4
07:23:22		
*	M	I had no observation but we heard a noise
*	M	No ob
*	M	No observation at that window

*	M	You all back there eating eating
*	F	No I'm not I'm putting the -
*	M	Yes you are
*	F	- stuff in the cooler see [laughs]
*	F	See you want one [laughs]
07:26:51		
	S-3	Sierra-3 has no vision of that window er
		Hotel was advised of that prior
*	M	Roger
07:27:06		
	H-1	Sierra-1 Hotel-1 we have a er partial view
		we don't see anything up at the window er
		the window is broken up though
		[Microphone contact noise]
*	M	Came into view just for a second there
*	M	Yeah it's right here
*	M	Yeah it's right there there's the corner
		[Microphone contact]
*	M	Where you looking
07:28:15		
	S-3	Sierra-3 to TOC and and Hotel we have
		vision of Red Charlie One but the Red
		window in the tower we cannot see
*	M	Oh boy [Very faint]
*	M	Zero romeo whiskey contact Grey approach
		one three two point zero five
*	M	Thirty two zero five good day sir

*	M	And six Sierra Hotel contact grey approach
		one three two point zero five
*	M	One three two zero five Sierra Hotel good
		day
07:29:48		
	S-3	Sierra-3 to TOC the er gas tank just
		delivered gas into Red Alpha One it
		appeared he received a round out the same
		window
07:30:04		
	S-TOC	Sierra-3 the CEV with gas just delivered gas
		to Red Alpha One it appeared he received a
		round from inside that window
	S-3	It appeared so yes
07:30:21		
	S-1	Sierra-1 to Sierra-TOC er we'll confirm that
		about Sierra-3 we thought he took a round er
		when he stuck the boom in
07:30:57		
	D-1	Dallas-1 to Forward-TOC Monty advises
		he has enough gas for his system to load
		both tracks five more times
07:31:28		
*	M	CEV-2 will be ready
*	F	Starting to look a little better
07:31:42		
	D-1	Er be advised negative

	D-1	Be advised negative
*	M	Idaho six one waiting for departure radar
		contact
*	M	Roger stick there
*	M	Yes Ross six one (right on)
*	M	Did you catch that six one's coming up
*	M	Yeah
*	M	Who's six one Idaho or er I mean er Ross
		or the
*	M	It'll be one of the one eight twos
*	M	There it is off the window
*	M	Found that hole
07:33:13		
*	S-2	That's correct there are no rounds at Sierra-2
*	M	Pulling back away's
*	M	That next hole on the top of the screen I'll
		come around
07:34:20		
	F-TOC	Dallas-1 Forward-TOC
	F-TOC	Monty advises the contact point is Advanced
		Materials New York City break
	F-TOC	And Cindy Long at Quantico has the
		numbers
07:35:00		
	F-TOC	Er for Monty's er system and Cindy Long
		has the numbers er at er Quantico

07:35:23

	F-TOC	Alright say that again one more time
07:35:41		
*	M	Er Forward-TOC be advised if one can come
		down here he's in the process of re-loading
		and can't come up
	F-TOC	10-4
		[Radio noise]
*	M	[Intermittent transmission]
*	M	What altitude does he have
*	M	Don't know he's got to be about two
		thousand
*	M	Do you see him underneath it or something
*	M	No
		[Radio noise]
*	M	Er at twenty one hundred he's got to be under
		it
*	M	Yeah sure he is
*	M	With wide turns
		[Radio noise]
		[Breath into microphone]
07:38:19		
*	M	Sierra-1 go ahead
*	S-1	10-4 stand by
*	M	There's one you can see
*	M	Yep
*	M	I see him to the east is the compound
*	M	Where's the east
*	M	To his left wing
*	M	Yeah

*	M	Er left wing er
*	M	I'll bring you down that er west side of that
		hole again like the last time
*	M	Cloud didn't break up unless it's warm
*	M	Oh popeye
*	F	To break
*	M	Right down there
*	M	We're gonna lose that we're gonna lose
		that again
*	M	Twenty one hundred still just checked it
*	M	No
*	M	It is breaking though
*	F	There's a little more break coming up here
		do you see
*	M	Er lose it for a little while
*	M	Forth Worth Centre er
*	M	Waco approach er Life Guard niner eight
		seven seven Hotel with you climbing
		through er seven thousand two hundred
	WA	Life Guard niner oh eight seven seven
		Hotel Waco approach Waco altimeter two
		niner seven one
*	M	Two niner seven one
07:48:52		
	HR-2	Yes we probably HR-2 to HR-1
	HR-1	Go ahead this is HR-1
	HR-2	Currently re-supplying Charlie-1 there's
		relative safety er utilising the vehicle for

		cover and attempt to get penetrate the er
		construction project
	HR-1	You're talking about the black over the top
		of the construction
	HR-2	Say again er HR-1
	HR-1	Are you saying he can penetrate the black
		covering over the construction on the green
		side
	HR-2	10-4 he thinks we can get into position and
		relative safety utilizing the track for cover
		and attempt to penetrate it with er military
		rounds
	HR-1	Roger of course if there is er water
		underneath it's just going to extinguish them
		but you can try it
	HR-2	Yes 10-4 copy you can try it
	HR-1	Yeah that's affirmative
*	M	seven two one zero on Waco approach
		required to two niner six approach see
		directly over Waco (VOR) heading now on
		zero one zero
		[Simultaneous Transmission]
07:49:52		
*	M	Yeah Forward TOC (Waco 1) be advised
		that for our safety inside that they stay low
		and stay ready er as if they are expecting
		some kind of an assault
	HR-1	Roger copy
07:50:26		

	SAC	HR-1 this is SAC Santonio
	HR-1	Yeah go ahead SAC Santonio
	SAC	SO tells they're taking the masks off and on
		inside one person asked have we been
		gassed
	HR-1	Er say the last I didn't er copy that
	SAC	They're they're taking the masks off and on
		and a person said have we been asked the
		question have we been gassed so there's an
		area that we're not getting the gas into
	HR-1	And where do we think that might be
		[Simultaneous transmission]
*	M	[in background] almost got the (local) by the
		back porch something wrong with one of
		them
	SAC	Where near where we where we have er
		the box
	HR-1	And where is that er SA-1
	SAC	That's er speculation er we think the kitchen
		area
		[Simultaneous transmission]
*	M	(Bonanza) one zero niner turn right heading
		on zero four zero vector 25 on approach
		course
	HR-1	That's where we punch in
	SAC	Pure speculation
	HR-1	Roger
	SAC	It could be the area you were talking about
		last night around the cooler

*	M	around four thousand
	HR-1	Yeah 10-4
07:51:37		
*	M	Did it sound like er (Koresh) had his mask
		off while he was talking
		[Radio noise]
*	M	(Bonanza) one zero Lima you are one zero
		miles from us maintainer on four thousand
		'til steps on localiser query localiser back
		course runway one approach show up on
		runway one nine
*	M	[Intermittent transmission]
*	F	Gonna switch the tape in about five
07:52:32		
*	M	[in background] what about the others you
		don't know why
	S-2	Sierra-2 to TOC er Green Bravo Five
		window has just been opened
		[Radio noise]
*	M	[extremely faint] get the adult channel on
		that's where all the action is gonna be
		[Radio noise]
*	M	Bonanza one zero Lima contact the Waco
		tower one three five point two good day
07:54:35		
	HR-1	HR-1 to Forward-TOC
	F-TOC	Go ahead for Forward-TOC

	HR-1	Yeah did you plan on er having a er Army
		fuel truck here by two o'clock for er
		refuelling these vehicles
		[Simultaneous transmission]
*	M	[in background] the thing is
*	M	[in background] Lima one seven er Waco
		approach Waco altimeter two nine seven two
		my heading
	F-TOC	10-4 that's er refuel the Bradley's and the
		CEV's
*	M	[Simultaneous transmission] One five zero
		assume caution and proceed direct in and
		advise on
	HR-1	And the Abraham's
*	M	[in background] and maintain one three
		thousand
	F-TOC	Roger copy
*	M	This is two niner
07:55:04		
	HR-2	HR-2 HR-1
*	M	[in background] the rest I didn't catch it
		remained garbled
*	M	Lima one seven currently maintaining one
		three thousand
*	M	Roger one three thousand
07.55:30		
	HR-2	HR-2 to Hotel Track
	Hotel	Hotel Track go ahead

	HR-2	Are you in need of re-supply of er ferret
		rounds
	Hotel	Negative we're in good shape for right now
	HR-2	10-4
*	M	Tanks have moved in against the front side
		the er north side
*	M	Sky 4 Waco departure radar contact maintain
		VFR window Waco regional one eight zero
		at one two altimeter two nine seven two
*	M	(King Air) one seven contact Fort Worth
		centre one three three point three and have a
		good day
*	M	[faint] Roger one three three Fort
		Worth have a good day
*	F	Dave you want me to
		[Simultaneous transmission]
*	M	Yeah Waco information got an altimeter
		two nine seven two
*	F	Hey Dave-
*	M	What)
*	F	-you want me to put a new tape in the top
		one too
*	M	Yep
*	F	Okay
*	M	[extremely faint] Keep both running always
		[Intermittent transmission]
07:57:35		
	F-TOC	Forward-TOC to er HR-1 er SAC requests to
		know if we're taking any fire

	HR-1	None reported stand by
07:58:10		
	HR-1	HR-1 to Forward-TOC er no fire reported
	F-TOC	Forward-TOC copy
07:58:21		
*	M	Advise SA-1 that er the building appears to
		be extremely poorly made er very very
		poorly made
07:58:37		
*	M	Er that that's very obvious 10-4
*	M	Sky 4 (crew) change approved
*	M	Sky 4 roger
07:59:59		
	SA-1	SA-1 to HR-1
08:00:02		[Video turned off]

Transcript

Lab ref: 00053/AV

Tape ref: Enhanced copy of Audio Track from FLIR Q2 [07:58 - 09:28]

Tape reference CMM/3 & CMM/4

Key:

.. Natural pause

.... Indecipherable

() Sounds like

[] Descriptive text

- Continuation of speech

ST Sierra-TOC

S-1 Sierra 1

S-2 Sierra 2

S-3 Sierra 3

S-H Sierra Hotel

H-1 Hotel-1

D-1 Dallas-1

CT Charlie TOC

C-1 Charlie 1

E-1 Echo 1

G-1 Golf 1

CU Charlie Uniform

07:57:51		[Video commences]
07.58:10		
	HR-1	HR-1 to Forward-TOC no fire reported
	F-TOC	Forward-TOC copy
07.58:21		
	HR-1	Advise SA-1 that the building appears to be
		extremely poorly made er very very poorly
		made
07.58:37		
	F-TOC	Er that's very obvious 10-4
*	M	Sky 4 (crew change) approved
*	M	Sky 4 roger
07:59:59		
	SA-1	SA-1 to HR-1
	HR-1	Go ahead
	SA-1	Do you have the 37mm delivery system here
*	M	Waco approach this is Jet 5 Yankee
	HR-1	[Simultaneous transmission] Er standby
*	M	Centurion five four three four Victor Waco
		approach Waco altimeter two nine seven two
		one one maintain your approach stop on
		expected -
	SA-1?	[Simultaneous transmission]Want to be sure
		we have that er 37 ready
*	M	- on runway one nine
*	M	Roger VOR (DMA) er three two not not er
	HR-1	[Simultaneous transmission] Er HR-1 to SA-
		1 er we'll check on that -

*	M	(Jet) three four Victor I can give you that or I
	HR-1	- we also have er got a 12 gauge but er I I
		don't er not sure it's fully effective right
		now
*	M	Er you want it right
08:00:43		
	SA-1	SA-1 to HR1 I just talked to Monty Jett he
		suggest we stop until the wind gets lower
*	M	Er arrive maybe
	HR-1	Okay let's er go ahead and take er a CEV-1's
		er four shots and put them in that er Upper er
		Bravo One through Four I'm sorry lower
		Bravo or Alpha One through Four and then
		er we'll we'll see
*	M	[Simultaneous transmission] Yeah
		planned on give you the VOR then go ahead
		circle runway one nine when you get to the
		airport
*	M	Okay
	SA-1	10-4 roger
*	M	Thank you
08.01:12		
*	SA-1	Uh um I got er Coulsen on the line and he's
		asking about the 37's so you get back to me
		I'll tell him whether we want it brought out
		here or not
	HR-1	Yeah roger that
08:02:06		
	SA-1	SA-1 to HR-1

	HR-1	Yeah go ahead SA-1
	SA-1	I've got Monty heredo you one through
		five and then insert on er lower level
	HR-1	HR HR-1 to Monty I can only read about
		every third word say again
	SA-1	Do you want an additional reload and to
		insert on lower levels
	HR-1	That's affirmative I want er four more shots
		for Alpha One through Four and then we're
		gonna er cease fire for a while
	SA-1	10-4 he copied
08.02:58		
	HR-1	HR-1 to HR-2
	HR-2	Go ahead
	HR-1	Yeah can you determine whether or not we
		have a 37mm system with us in the mount
		up
	HR-2	I believe that's negative but I think some of
		the SWAT teams still have them
	HR-1	Okay can you work on getting a readout er if
		you've got 'em then er we probably have a lot
		more 37 er ferrets
	HR-2	10-4
08.03:34		
	HR-2	This is HR-2 to HR-1
	HR-1	This is One go ahead Two
	HR-2	Suggest when that er CEV puts the four
		shots in Alpha One through Four then er he

		you might think about having him open up er
		the front door Alpha Ten
	HR-1	You say after he er puts them in er go ahead
		and open up their front door
	HR-2	10-4
*	M	Smart
	HR-1	Yeah I concur I think it's a good idea break
		do you copy SA-1
	SA-1	Uh yes we copy and SAC concurs
	HR-1	Roger
*	M	Centurion three four Victor say your heading
*	M	[faint] Three four Victor heading er three
		one zero
08.04:17		
	HR-2	HR-2 Dallas-1
*	M	Centurion three four Victor roger turn right
	D-1	Dallas-1 go ahead
*	M	One zero degrees and maintain three
		thousand
	HR-2	
	ПК-2	Will you ascertain the number of 37mm
	ПК-2	Will you ascertain the number of 37mm delivery systems the SWAT teams on scene
	ПК-2	·
	D-1	delivery systems the SWAT teams on scene
		delivery systems the SWAT teams on scene have
*		delivery systems the SWAT teams on scene have Er we're gonna come out and search in a
*	D-1	delivery systems the SWAT teams on scene have Er we're gonna come out and search in a minute
*	D-1	delivery systems the SWAT teams on scene have Er we're gonna come out and search in a minute [in background] descend descend to

	HR-2	[Simultaneous transmission] You're coming
		in you're coming in broken DL-1 cannot
		copy
08.04:57		
	HR-2	HR-2 Forward TOC
	F-TOC	Go ahead HR-2
	HR-2	Will you use the er (CL) phone and reach
		(GL1) at er the pass that message regarding
	F-TOC	HR-2 you came in broken 10-9
	HR-2	swat teams have on scene here
		[Breath into microphone]
	S-1	Sierra-1 Sierra-TOC um the opening we
		made in Bravo Two er a unknown subject
		just crossed er into er that room and moved
		out
	S-TOC	Is that on the er Red side Sierra
	S-1	Sierra-1 can only see the White side
	S-TOC	That's er Sierra-1 reporting (Bravo) two
		window
08.06:18		
	S-1	Sierra-1 Sierra-TOC er that individual
		moved er across the window er into er what
		looked like Bravo One and then moved back
		out
*	M	Waco approach we're there for 3 3 5
	S-TOC	10-4

* M three three five Tango Charlie V approach good morning Waco altimeter niner or seven two * M Twenty nine seventy two	two
niner or seven two	you
	•
* M Twenty nine seventy two	•
	•
* M Centurion three four Victor have	0
intercepted the er now on approach cour	æ
* Yeah that's affirmative	
* M Centurion three four Victor roger	
* M Cleared VOR (DME) three two appr	oach
circle on the runway one nine	
* Yeah I'll make a right	
08.07:58	
CT Charlie TOC to HR-1	
CT Yeah the military gas did not penetrate	that
er bunker near the bus yard copy	
CT Just bounced off	
CT That's a possibility if if the next time	the
CEV could push the fence back here so	you
could get in there and get a good angle	
CT I don't think so because it's low	
08:08:52	
* M The walls to this thing are concrete pour	ed
* Yeah the walls to the er around the bu	are
poured concrete	
08:09:24	
Echo-1 Echo-1 to Charlie-1	
Charlie-1 Go ahead Echo-1	

	Echo-1	Yeah if you come to the er green black side
		of that structure I think there's an opening
		there that you may be able to shoot through a
		doorway
	Charlie-1	Is it an underground bus
	Echo-1	Er it's just the green side of the er big water
		tower
*	M	Waco approach Centurion 3 4 Victor broke
		out at er twenty six hundred and I'm at the
		airport
*	M	Centurion three four Victor roger and you
		now cleared visual approach runway one
		nine and you are downwind
*	M	Roger that
08:10:02		
*	M	10-9 HR-1
	HR-1	If you come just to the green side of the big
		tall water tower er toward the White side
		from there you should be able to see a-
*	M	[in background] Tower approach this is
		600 at
*	M	10-4
	HR-1	-a doorway in the unconstructed part
*	M	(3 8)
*	M	Yo
*	M	What'd he say
*	M	What

*	M	Centurion three four Victor contact Waco
		tower one three five point two have a good
		day
08:10:27		
	S-1	Sierra-1 to Sierra-TOC we had another
		individual in er Bravo Two er the first
		individual's wearing a white suit break like
		a white sheet break second individual
		looked like he was wearing a poncho liner er
		had a box in his hand and walked out
	S-TOC	10-4
	S-1	Sierra-1 can only see the White side
	S-TOC	Give us that opening one more time Sierra-1
	S-1	Bravo Two
	S-TOC	Copy that
	F-TOC	Forward TOC to
*	M	[Simultaneous transmission] nine oh eight
		seven seven oh two contact grey approach
		one three two point zero five have a good
		day
08:11:39		
*	M	[Simultaneous transmission] point zero five
		good day
	F-TOC	Yeah be advised er medical personnel will
		be approaching your location er in one of the

Secret Service Suburbans break .. they'll be

carrying some water and rations so not to be

concerned with their vehicle movement at

your position .. copy

*	M	He copies
08.12:10		
*	M	at the (Y) did you copy
*	M	Er (Y) copy
*	M	Waco approach King Air one Victor Romeo
		switching over nine point two four one one
		thousand
*	M	King Air One Tango Romeo Waco approach
		Waco altimeter two nine seven two proceed
		direct to the Waco VOR resume own
		navigation
*	M	Two nine seven two direct to Waco on own
		navigation one
*	M	King Air One Tango Romeo contact Fort
		Worth centre on one three three point three
		have a good day sir
*	M	Thirty three three see you later
08:15:05		
	S-2	Sierra-2 to TOC the obstruction in Black
		Bravo Three has been removed and the
		window is open
	S-TOC	-4 Sierra-2
*	M	Your on
08:16:14		
		[Radio noise]
	G-1	Sierra-1 Golf-1
08:16:26		
	S-1	Sierra-1 TOC
		[Radio noise]

	S-1	See if you can get a hold of the Golf er track
		out on the White side er he may want to fire
		a er a ferret into the Bravo Two opening on
		the White side we've got some movement
		in there
	S-TOC	10-4 er Golf-1 did you copy that direct
	G-1	Yep
	S-TOC	Sierra-TOC to Golf-1
	S-TOC	Yeah be advised Golf-1 copies direct
*	M	Good morning Waco (Contest) niner two
		niner zero three with you at er seven
*	M	(Contest) nine two nine zero three Waco
		approach good morning Waco altimeter two
		nine seven one
*	M	Roger
08:17:24		
*	M	Test 1
*	M	Test 1 2 3
		[Radio noise]
08:18:34		
	F-TOC	Forward-TOC to HR-1
	HR-1	This is HR-1
	F-TOC	SAC requests sit rep on timeframe of er
		CEV deployment
	HR-1	Roger standby
08:19:01		
	CEV-1	CEV-1 to Forward-TOC
	F-TOC	Go ahead

	CEV-1	Yeah we have two bottles filled we have two
		more to go approximately thirty minutes
08:19:59		more to go approximately unity immutes
00.13.63	SA-1	SA-1 HR-1
	HR-1	Go ahead SA-1
	SA-1	Er Dallas has had some er 37mm ferrets er
		do you want us to get headquarters to send
		37mm ferrets
	HR-1	You mean they've got the guns at Dallas
	SA-1	They got two
	HR-1	Okay and er head and er headquarters has er
		liquid CS rounds for those
	SA-1	That's affirmative
	HR-1	Yeah let's go ahead and er send out er what
		they've got we can always use 'em
	SA-1	How soon is er CEV-1 going to be able to do
		the front
	HR-1	In about er thirty more minutes they've er
		filled two bottles they got two more to go
	SA-1	10-4 thank you
*	M	Seeing lots of holes but it's still hazy in
		between 'em
*	M	Yeah lot of moisture out there yet
*	M	Yep
*	M	SA-1 er
*	M	Showing one hour forty
*	M	Yeah anybody got the er
08:21:31		
	H-1	[Simultaneous transmission] Hotel-1 to er-

*	M	[in background] um what number
	H-1	-HR-10
*	M	Er yeah maybe we'll just call er Tom direct
*	M	Call him direct yeah
*	M	That was nine four four oh I don't know
		what the first bit is
*	M	Eight one seven
*	M	Oh [groans]
*	M	How do we do this here
*	M	Seven seven two
*	M	Ah just hang up yeah
*	M	And then er listen for a dial tone and then
		one eight seven seven two nine four
		four zero and er ask for Easton
*	M	Eight one seven what was the rest of it
*	M	Seven seven two nine four four oh tell
		him one hour
		[Breath into microphone]
*	M	Get (advice) from them
*	M	Good morning Waco approach Rider one
		hundred with you nine thousand through one
		zero thousand
*	M	Rider one hundred Waco approach good
		morning Waco altimeter two nine seven one
*	M	Two nine seven one
*	M	(Contest) on niner oh zero three contact Fort
		Worth centre on one three five point three
		seven and have a good day

*	M	Thirty five thirty seven and have a very good
		day sir
*	M	Waco approach Bonanza eight three four
		five November's twenty nine (VME) north
		east landing Madison 2 runway
*	M	three four five November Waco approach
		Waco squawk five zero three zero one ident
*	M	Alright
*	M	They wanna know if anything is going on
		see whether we're still active
*	M	I would imagine he'd er they'd have it on the
		news I mean the helicopter came down here
*	M	I'd see if you could find
*	M	Hey er turn off the record audio for a little
		while
*	F	Do what
*	M	Turn off the audio
*	F	Okay
08:24:30		
		[Audio turned off]
08:41:15		
		[Audio turned on]
*	F	It's on
*	M	Label the other two tapes that you took out
*	F	I did
*	M	Ok put the times on em
*	F	Yeah
*	M	One zero Charlie Uniform radar contact two
		one miles north of the Waco airport Waco

		altimeter two nine seven two make straight
		in runway one zero Charlie Uniform
*	M	Roger er straight in one nine one zero
		Charlie Uniform]
*	F	Any labels up there on that seat oh yeah
		want me to put them in
*	M	Here
*	F	Those needed rewinded I didn't rewind 'em
*	M	Helicopter eight Tango Victor Waco
		approach
*	M	Affirmative er you can request
*	M	Helicopter eight Tango Victor affirmative
		it's still off er the Waco one zero zero radial
		at one five DME
*	M/F	[Sneezes]
*	M	Helicopter Eight Tango Victor er [sound of
		aircraft] ident on
*	M	Helicopter Eight Tango Victor ident
		observed two zero miles north east of at the
		Waco airport wind at Waco regional is one
		eight zero at two zero
*	M	Cessna one zero Echo Waco er departure
		radar contact turn er correction climb
		two and report reaching VFR on top if not
		on top by one one thousand maintain one
		one thousand nine five last er no tops
		reported
*	M	Waco this is nine ninety one six thousand
		Yankee

*	M	Helicopter Eight Tango Victor standby
		zero Charlie Uniform contact Waco tower
		one three five point two
	CU	Charlie Uniform roger
*	M	November one zero Echo say your
		destination airport
*	M	Right
*	M	Approach out of the south at nine seventy
		nine
*	M	Helicopter Eight Tango Victor go ahead
*	M	We got runway one seven right
*	M	Er Helicopter Eight Tango Victor negative
		other than the ones that supposed to be there
*	M	Waco this is nine ninety one six thousand
		Yankee
*	M	Yes nine ninety one Waco approach we've
		got altimeter two nine seven one [sound of
		aircraft] try heading one six zero Vector to
		final approach course pilot discretion
		maintain two thousand three hundred
*	M	One six zero for Vectors [intermittent radio
		transmission] about three hundred is that
		correct]
*	M	November one zero Echo roger
*	M	Uh oh I don't know where it is Ike
*	M	Huh
*	M	Don't know where it is
*	M	Oh hell hang on it's
*	M	Follow the stars and see what happens

*	M	Echo calling Waco approach say again
*	M	Cessna one zero Echo roger resume your
		own navigation and I understand you're
		cancelling your IFR
*	M	Cessna one zero Echo roger resume your
		own navigation and I understand you're
		cancelling your IFR clearance
*	M	Cessna one zero Echo roger cancellation
		received and you remain on your present
		code then I'll give flight following on to
		(Lano)
*	M	Cessna one zero Echo roger standby
*	M	Cherokee four five Whiskey contact grey
		approach one three two point zero five have
		a good day
*	M	Thank you one three two point zero five
*	M	Hello Waco this is nine ninety one did you
		want us to join the localiser
*	M	Yes nine ninety one sorry about that
		intercept the localiser track inbound
*	M	[Simultaneous transmission] Er yes this is
		TOC radio check
*	M	Inbound on localiser
*	F	Seven seven ninety one we're at ten thousand
		joining WACO's
*	M	Seven seven ninety one Waco approach
		resume all navigation we -
*	M	[Simultaneous transmission] Sierra TOC
*	M	two nine seven one

*	F	Two nine seven one seven ninety one
*	M	Who wanted a radio check
*	M	Cessna one zero Echo would you like to go
		direct to (temple) and then on over to (Lano)
*	M	Cessna one zero Echo er roger I'll put your
		request on with grey approach and they'll be
		able to er vector the (MOA)
*	M	Did you guys see the swimming pool out
		the window and
*	M	Yeah someone's turned on the
*	M	Is it filled in
*	M	Er can't tell it's too hazy down there
*	M	It's not showing dark like water is it
*	M	Ninety one er verify you're on the localiser
*	M	Affirmative on the localiser and
*	M	Oh it looks green
*	M	Eighty nine nine one roger maintain that go
		up two thousand three hundred to westerly
		inbound cleared (ILS) approach
*	M	[faint] What are we gonna do with the erm
*	M	Never mind we'll make sure like
*	M	One more
*	M	Don't figure
*	M	Cessna one zero Echo verify you'll be
		staying at four thousand five hundred
*	M	Cessna one zero Echo contact grey approach
		on one three two point zero five and have a
		good day

	HR-1	HR-1 to HR-2
*	M	Hello it's Waco departure radar contact fly
		heading of one nine zero now climb and
		maintain seven thousand this'll be vector
		round a restricted area
08:55:53		
	HR-1	HR-1 to HR-2
	HR-2	Go ahead
	HR-1	How about you plan er on meeting me er
		back at the Y with the SAC when I leave
		here
	HR-2	10-4 copy you're going to go back to the Y to
		meet with er SAC
	HR-1	That's affirmative as soon um CEV-1 er
		dumps their load
08:56:23		
	F-TOC	Forward to CEV-1
	HR-2	HR-2 to 1
	HR-1	Go ahead two
	HR-2	Did you want this unit to return to the Y also
		or to stay on station
	HR-1	Er why don't you have that unit er stay on
		station you can go with us
08:56:52		
	CEV-1	Forward-TOC CEV-1
	F-TOC	Go ahead CEV-1
	CEV-1	We're about ready to depart the er loading
		area here any specific instructions on these
		four bottles

	F-TOC	Check with HR-1 re instructions on the
		delivery
	M	[faint] Okay
	CEV-1	Roger er HR-1 this is CEV-1
	HR-1	Yeah CEV-1 er like you to put those in er
		Alpha white Alpha 1 through 4 and also er
		open up the front door
*	M	[Simultaneous transmission] Waco yes
		information Zulu one altimeter two nine
		seven one
*	M	Eighty nine ninety one er Tower advises we
		are change visuals into one nine let me know
		when you get to the airport
	CEV-1	I copy White Alpha 1 2 3 and 4 and open
		up the front door
	HR-1	That's affirmative
*	M	[Simultaneous transmission] Roger er
	CEV-1	Roger be leaving the er loading area in about
		two minutes
	HR-1	Roger copy
*	M	Course the clouds could move in and stop
*	F	Lets hope not
*	M	Eighty nine ninety one this airport track
*	M	Eighty nine ninety one cleared visual
		approach one nine make straight in contact
		Waco tower one three five point two have a
		good day

*	M	Cleared for visual one nine go to tower
		eighty nine ninety one
*	M	Now eight Alpha Tango turn left heading of
		one seven zero
08:58:50		
	S-TOC	Sierra-2 Sierra-TOC
		[Radio noise]
	S-TOC	Sierra-2 Sierra-TOC
	S-2	This is 2 go ahead
	S-TOC	We had a report come in er from ATF that
		they've er spotted a maroon vehicle coming
		er approaching the Black side down Frasier
		Road er scratch that it's an unsub on foot
		coming off er Frasier Road towards the
		Black side copy
	S-2	10-4 copy
*	M	(Sierra) 6-1 copy we're looking
*	M	[Simultaneous transmission] Did you copy
		that
*	M	Yeah I heard it there's a
*	M	6-1 going off call
*	M	Yeah but the cloud cover I couldn't do
		anything for 'em
*	M	Okay 6-1 go after them they're headed that
		way
*	M	Sniper-TOC
08.59:50		

*	M	Er Sniper-TOC you gonna have a Falcon
		unit er launching regarding the people er
		approaching on foot
	S-TOC	10-4
09:00:11		
	S-2	Sierra-2 to TOC
	S-TOC	Go ahead 2
*	M	Who's on medical staging
	S-2	Well we have people responding back
		behind our position in reference to that
		individual
	S-TOC	10-4
09:00:35		
	SA-1	HR-1 SA-1
	HR-1	Go ahead er SA-1
	SA-1	Are you going to deliver gas in White Alpha
		12
*	M	Er we're having some
	HR-1	Er negative we're going to deliver it to White
		Alpha 1 through 4 and then open up 12
*	M	Prisoners
	SA-1	10-4 I just wanted to make understand
*	HR-1	Roger that do you wanna open the front
		door and then er they will following er
		delivery in one through four of gas
*	SA-1	Understand
09.01:09		
*	M	Er Medical control from staging do you copy
		that

*	M	Alpha Juliet turn left direct line over
		no correction way over resume own
		navigation
09.01:35		
	HR-2	[Simultaneous transmission] HR-2 to 1
	HR-1	Go ahead 2
	HR-2	If you want gas in the front door after er it's
		punched through Golf units can send in
		ferret rounds
	HR-1	Yeah right now I think that's the last place
		we want it er trying to give 'em an exit there
09.01:56		
	Falcon-2	Sniper-TOC Falcon-2
*	M	San Antone ninety one descend at pilot's
		discretion maintain six thousand
	Falcon-2	Sniper-TOC Falcon-2
*	F	Pilot's discretion six thousand
	Falcon-2	Sniper-TOC Falcon-2
	HR-1	Sniper-TOC Falcon-2 is calling you
*	M	Just long enough to er
	S-TOC	Go ahead Sierra-2
	Falcon-2	Sniper-TOC Falcon-2
*	M	-nine seven one are you looking for
*	Falcon-2	This is Falcon-2
	M	We've launched for the unsub
*	M	We can maintain one one thousand flying-
	Falcon-2	10-4
*	M	

*	M	Do you copy Falcon-2 has launched for the
		unsub
	S-TOC	Roger that Falcon-2
09.02:56		
	Echo 5 – 2	Falcon-2 from Echo 5-2 Falcon-2
	Falcon-2	Go ahead for Falcon-2
	Echo 5-2	Er Echo 5-2 is er back here on foot to cover
		that unsub so talk to me direct
	Falcon-2	Okay you got it Echo 2 say your location
		Echo 2
	Echo 5-2	This is Echo 5-2 Echo 5-2 is er East of
		Sierra-2
	Falcon-2	Okay Echo 5-2 er we're about 30 seconds out
*	M	Helicopter Sky 4 Waco departure ident
*	M	Sky 4 radar contact six South East of Waco
		altimeter er two nine seven one
*	M	Roger
*	M	Come on seven-
*	M	Is that gonna clear at all
*	M	-er correction seven seven nine two one
		contact grey approach one three two point
		zero out
*	M	[Simultaneous transmission] we've got a
		hole coming our way so -
*	F	This is two oh five seven ninety one good
		day
*	M	Check the (CEN)
		` '

*	M	I'm on now but I think we're gonna lose it on
		the other side yeah gonna lose it on the
		other side yeah it's thick off the other side
09.04:47		
	Falcon-2	Echo 5-2 Falcon-2 say the location of the
		unsub if you have it
	Echo 5-2	Uh I I have no location er Falcon-2
	Falcon-2	Okay we copy
*	M	Is it er getting any higher or is it staying
		down on the deck
*	M	Looks like it's coming up real slow-
*	M	Quite a height to clear
*	M	-still ragged though it's gonna take most of
		day before it dissipates
09.05:44		
*	M	Five you need to lower that boom a little bit
		if you can
*	M	Navaho eight Alpha Juliet contact Fort
		Worth centre one three three point three
		good day
*	M	I don't think we're gonna see it for awhile we
		gotta nice big cloud covering it
*	M	Helicopter 1-3 Tango Delta Waco approach
*	M	Helicopter 1-3 Tango Delta it's squawk zero
		three seven four ident
*	M	Helicopter 3 Tango Delta we have contact
		now-
09.06:47		
	Echo 5-2	Falcon-2 from Echo 5-2

*	M	- South East of Waco
	Falcon-2	Echo 5-2 Falcon-2
*	M	
	Echo 5-2	Uh ATF units reported seeing an unsub so
		you might want to contact them direct to er
		get a location
	Falcon-2	We're on the ground we're contacting the er
		ATF
*	M	Helicopter 3 Tango Delta roger understand
		landing (TSTC)
*	M	Roger (TSTC) landing runway one seven
		one after line wind at Waco regional
		airport one nine zero at one five
*	M	Seven seven six two eight approach radar
		our contact turn right heading three two five
		for seven eight active proceed direct in and
		maintain six thousand
*	M	Seven seven eighty one receiving er calling
		station you are to proceed direct in
09.07:44		
	Sierra-1	[Simultaneous transmission] Sierra-1 to
		Sierra-TOC we have a banner or some
		object being stuck out of Bravo 11
	Sierra-1	"We want our phone fixed" the banner says
		"we want our phone fixed"
*	M	[Simultaneous transmission] forty nine
		thousand one seven (zero) at a heading
*	F	[Chuckles]

*	M	niner 0 zero one one Waco approach
		altimeter two nine seven one flight heading
		heading one five zero
	Sierra-1	Sierra-1 to Sierra-TOC do you copy
*	M	150 2 niner zero one
	S-TOC	Sierra-TOC copy
*	M	Seven seven eighty one this is Waco calling
		station
*	M	Seven seven eighty one say again
*	M	Over er calling station
*	M	Roger
09.08:30		
	HR-1	HR-1 to er SA-1
	HR-1	HR-1 to Forward-TOC
	F-TOC	Go ahead HR-1
	HR-1	Yeah suggest we have er Byron tell them
		that er the solution is to walk out the front
		door
	F-TOC	That's 10-4 that'll be passed
*	M	There goes the tank up to the front
*	F	There goes a tank up to the
*	M	Got a hole coming through
*	F	Is that one or two just one
*	M	One just one it's gotta white er alpha one
		work his way down to the with a
*	M	Waco approach to Walker six one seven
		Juliet Mike with you at five thousand eight
		hundred going to eight

*	M	Walker six one seven Juliet Mike Waco
		approach altimeter two nine seven two flight
		heading er one five zero
*	M	call for it
*	M	[Chuckles]
*	M	Seven Juliet Mike two nine seven two and
		one five zero
09.09:55		
	Falcon-2	Echo 5-2 er Falcon-2
	Echo 5-2	Echo 5-2 go ahead Falcon-2
	Falcon-2	We contacted ATF on the ground and they
		have only located a er rental vehicle that is
		abandoned break also ATF is in black T-
		shirts out here Sheriffs are in white they
		gave
*	M	nine two Waco approach altimeter two
		nine seven one
*	M	Gonna get your hole hang on
	Echo 5-2	10-4 negative sighting
*	M	seven on seven nine two
		[Radio noise]
*	M	Er then one one two
*	M	Er clouds are coming in again
*	F	Oh
*	M	If we do it I don't think it'll
*	M	Yeah we're about thirty seconds out from
		track
*	M	Call Ike
*	F	Calling Ike come on [chuckling]

*	M	They're calling you on
*	M	Not cool [groans]
*	M	Helicopter Tango D- Delta-2 er stand
		clear of the restricted area suggest you
		continue er your present heading to
		interstate 35 and then er enter the (TSTC)
		from the South West
*	M	Roger er interstate is er twelve o'clock and
		er one two miles and when you see the
		interstate just follow it to the er North and
		that'll bring you down the West side of
		(TSTC)
*	M	Seven seven ninety two affirmative
*	M	Er say again for seven seven nine two
*	M	Seven seven six two-
09.12:04		
	Falcon-2	Sierra-TOC er Falcon-2
*	M	-understand seven seven ninety two you
		getting a er
	S-TOC	Go ahead
*	M	Er-
		Falcon-2 Two at and Falcon-3 are
		returning to the Silo
*	M	[Simultaneous transmission] -light chop in-
	S-TOC	10-4
*	M	-appears to be getting better the higher we go
*	M	Roger
*	M	Seven seven six to two company's out at
		six thousand eight hundred climbing says er

		occasional light chop but it appears to be
		getting better the higher he goes
*	M	Seven seven six two go on and maintain
		eight thousand
*	M	There he goes at the front door
*	F	Yeah
*	M	Not to worry right
*	M	Yeah it's
*	F	Yeah
*	M	I think they oughta run out a (stupid) flag
		pole
09.13:26		
	S-3	Sierra-3 to TOC we opened up a nice hole
		we can see into the house and the stairway
		going up
*	M	Seven seven six two contact Fort Worth
		Centre one three five point three seven
*	M	nine zero one turn left heading for one
		four five
*	M	One four five
*	M	Carry on and get on this other side
*	M	Walker seven Juliet Mike receiving the
		college station VOR proceed direct to
*	M	Yes seven Juliet Mike er that's a
*	M	Yeah that's a little er rush
*	M	Sky 4 leaving air space to the North I'll be
		losing radar on you pretty soon radio
		service terminated squawk one two zero
		zero have good day

*	M	No when I get back I'm gonna go to sleep
		all keyed up now
09.14:20		
	Falcon-3	Falcon-3 to S-TOC
	S-TOC	Go ahead Falcon-3
	Falcon-3	3 is back at the triangle
09.14:41	HR-1	HR-1 to CEV-1 looks good thank you
*	M	Er good corridor yeah
*	M	Yeah HR-1 it looks good nice job
*	M	Seven seven ninety two contact Fort Worth
		Centre one three five point three seven
		good day
*	M	One thirty five thirty seven seven ninety two
*	M	(ASA) nine zero one traffic twelve to
		twelve thirty six miles North bound altitude
		er disregard it's a helicopter down low
*	M	Helicopter three Tango Delta report (TSTC)
		in sight
*	M	Helicopter three Tango Delta contact
		(TSTC)
*	M	One two four point zero
09.16:11		
*	M	Yeah go ahead CEV-1
*	M	Walker seven Juliet Mike climb and
		maintain nine thousand
*	M	Seven Juliet Mike going to nine
*	M	Waco niner one three six calling (Houston)
*	M	Call Waco approach say again
*	M	This is niner one on route to

*	M	Roger maintain your heading er and I'll
		advise you when you proceed direct
*	M	Yes er one niner one I guess they're kind of
		holding down there today huh
*	M	[Simultaneous transmission] They're over
		there
*	M	Yeah they're poking around
		[Direct microphone contact noise]
*	M	Seven seven eighty one contact Houston
		centre one three four point five good
		morning
*	M	Thirty four point five roger
09.17:51		
	G-1	Golf-1 to HR-2
*	M	niner niner to Waco approach radar
		contact turn round heading three two five
		four seven active VOR proceed direct 20
		miles climb maintain six thousand
*	M	There is smog over there
09.18:35		
	G-1	Golf-1 to HR-1
*	F	More clouds
*	M	HR
09.18:53	HR-1	HR-1 to HR-2
	HR-2	Go ahead
	HR-1	Yeah why don't you er bring it on up here
		here
*	M	Test
	HR-1	And we'll meet you at the (Y)

	HR-2	10-4
09.19:29	Golf-1	Golf-1 to HR-2
	HR-2	Go ahead for HR-2
	Golf-1	HR-2 this is Golf-1 er white Alpha 12
		appears to have a lot of-
*	M	Helicopter one one Tango Victor over
	M	-stuff around the door we tried to push it in
		but everything is hung up there break I'd
		like authorisation to go ahead and dump a
		couple of gas rounds in through the er
		opening there
*	M	Helicopter one Tango Victor squawk zero
		three zero three ident
	HR-2	That was already requested to HR-1 he said
		to hold off on that
	Golf-1	10-4
	HR-1	HR-1 to Golf er I want to leave one opening
		for them to come out of and that's the front
		door so let's try to keep gas everywhere but
		there
	Golf-1	Golf-1 to HR-1 er with the amount of stuff
		they've got there it maybe tough coming out
		that door
	HR-1	Er say again
	Golf-1	I say with the amount of stuff they have
		behind that door and the walled section it
		may be difficult for them to get out as it is
		now

*	M	Helicopter one one Tango Victor now
		receiving your transponder squawk -
	HR-1	[Simultaneous transmission] Okay but why
		do you want to put gas in there
*	M	Zero three zero three continue inbound and
		I'll identify your station er
*	G-1	[Simultaneous transmission] well you might
		get people coming back into the chapel area
*	M	Affirmative
*	HR-1	Okay let's just hold off a bit on that
*	M	Turn the (aux) off
*	M	because of the altitude I am not picking
		you up out there
*	F	You what
*	M	Turn the audio off
*	F	Okay
09.20:58		
		[Audio turned off]
09:28:20		
		[Video turned off]

`Transcript

Lab ref: 00053/AV

Tape ref: Enhanced copy of Audio Track from FLIR Q4 [10:42 - 12:16]

Tape reference CMM/5 & CMM/6

Key:

.. Natural pause

.... Indecipherable

() Sounds like

[] Descriptive text

- Continuation of speech

ST Sierra-TOC

S-1 Sierra 1

S-2 Sierra 2

S-3 Sierra 3

S-H Sierra Hotel

H-1 Hotel-1

D-1 Dallas-1

C-T Charlie TOC

C-1 Charlie 1

E-1 Echo 1

G-1 Golf 1

* M Unidentified male

* F Unidentified female

AWO Automated Weather Observation

MMA McGregor Municipal Airport

WA Waco Approach

[Video Commences] [No speech] 10:42:06

12:16:13 [Video ends]

Transcript

Lab ref: 00053/AV

Tape ref: Enhanced copy of Audio Track from FLIR Q5 [12:16 - 13:39]

Tape reference CMM/7 & CMM/8

Key:

.. Natural pause

.... Indecipherable

() Sounds like

[] Descriptive text

- Continuation of speech

ST Sierra-TOC

S-1 Sierra 1

S-2 Sierra 2

S-3 Sierra 3

S-H Sierra Hotel

H-1 Hotel-1

D-1 Dallas-1

C-T Charlie TOC

C-1 Charlie 1

E-1 Echo 1

G-1 Golf 1

* M Unidentified male

* F Unidentified female

AWO Automated Weather Observation

MMA McGregor Municipal Airport

WA Waco Approach

12:16:43		[Video commences]
		[No speech]
12:26:06		
*	M	Okay
*	M	All right audio's on
*	M	DED to Charlie-1
*	M	Turn it off a minute Arnie turn it off
*	M	Forward-TOC we got er one -
*	M	Off
*	M	on the grou
*	M	Is it off
12:26:15		[Audio off]
12:26:37		[Audio on]
*	M	Audio's on
*	M	DED one is leaving the scene now
*	M	Oh er a big fireball just came up from the
		middle maybe a magazine or something
	F-TOC	Break Forward-TOC to T
*	T	It's the T go ahead
*	F-TOC	Yeah make sure there is units at the T that you
		get the medevac personnel down to the rally
		point where the causalities are
*	HR-2	HR-2 to Forward TOC
	F-TOC	Go ahead
*	M	Unit calling
	HR-2	The third casualty is with Golf track moving
		towards the T we have minor casualties at the
		(site) location
*	M	Is only going on

12:27:42		
	S-TOC	Alpha-1 Sierra-TOC she's going back into
		Alpha 1 er there maybe more victims at Alpha-
		1 White side we need a truck over there ASAP
*	M	Why don't they just get out
*	M	Be warned the structure's about to collapse
	HR-1	HR-1 to Charlie-1
*	M	1 Alpha-2
12:28:24		
*	M	Sierra-1 to Sierra-TOC er that roof is gonna
		collapse will you tell the others she's still in
		Alpha-1 open Alpha-1
*	M	10-4 any track vehicle or vehicles that copy er
		and White Alpha-1 there's an individual here
		that needs help
*	M	White Alpha-1
*	M	Jack is that White Alpha-1
*	M	We'll do it now Arnie
*	M	That's the front
*	M	Yeah
12:28:50		
*	M	A woman wearing full cami
*	M	[Simultaneous transmission] On this side
*	M	In Alpha White right
*	M	On this side
*	M	Yeah
*	M	Forward Sierra-TOC she may be trying to get
		somebody out looks like she's on the ground

of White
of White
of White
Sierra 2 do
n) medical
ere-
lvised the
o the rally

*	M	You got the auto tracker on there Arnie or is
		that set
*	M	Yeah it's right on
*	M	They shouldn't have a problem staying on that
		should they
*	M	[Chuckling] I don't think so
	HR-1	HR-1 to er rear TOC if you have any fire
		vehicles get out there now
12:31:22		
*	M	Well it didn't take long it's almost completely
		gone
*	M	Yeah we'll have to check the time on the tape
		you know we-
*	M	Yeah
*	M	-first noticed the er the heat
	HR-1	HR-1 to rear TOC
*	M	How's that tape going down there Steven
*	M	The er bottom one
*	M	Yeah
*	M	Er got a little way yet to go
*	M	Okay
*	M	You want another one put it when this is done
*	M	Yeah as soon as it's er -
	SA-1	SA-1 to HR-1
*	M	- done pop that out
	HR-1	Go ahead HR-1
*	M	Yeah
*	HR-1	We'll have the fire trucks go to T centre then to
		receive their instructions

*	M	I amount a come Company to a company the company
	M	I want some fire trucks up here at the scene
*	M	Okay all those on scene we've been trying to
		bring them up from both sides
12:31:58		
*	M	The fire trucks are at both points
*	M	Say again
*	M	Within the on the hill roll two if we can
*	M	Roger yeah I don't know if they can get
		through or the other way
*	M	Ah I don't believe it
	HR-1	HR-1 to er SA-1 if you can er we want two
		rescue fire trucks going to the area where the er
		(mark) might be there's a chance we might
		still be able to save em
*	M	Is it my head set or is he coming through really
		muffled
12:32:37		
*	M	He's sort of coming through really garbled
*	M	Okay
*	M	No word on the children yet huh
*	M	Yeah they they thought they were in the
		bunker next to the er er bus
*	M	What does that mean is it out of the compound
*	M	Yeah they must evidently they must have had
*	M	Is it buried
*	M	The bus is buried on the-
*	M	Right
*	M	-green side
	1V1	-green side

*	M	Green White side
*	M	This side ok
*	M	So in other words they're safe from the fire
*	M	Well
*	M	I don't know
*	M	You don't know if any smoke's going in there
		or not there is evidently they had-
12:33:06		
	HR-2	HR-2 to Sierra 5
*	M	-a way of getting in there from under ground
*	M	Hey Tom
*	M	Yeah
*	M	You're gonna have to widen it out you're all
		turning me [breaks up]
*	M	What's that
*	M	You're all turning me
*	M	Okay
*	TOC-2	TOC 2 to Sierra-2
*	M	I can't go out too much wider though Arnie
		because I'll top it out [transmission breaks]
*	M	That medical track is not needed you'll have
		if you could come the other way round we
		have er someone with 3 rd degree burns on his
		left leg over here
*	M	This position we're headed forward
12:33:37		
*	M	Get
*	M	I will call
*	M	Might as well just go and keep it running

*	M	Ah Roger
*	M	What's your fuel state er Dash 3
*	M	Oh we got nine fifty
*	HR-1	HR-1 to Charlie-1 do you have any information
		on the kids
*	M	[Simultaneous transmission]
12:35:03		
	SA-1	SA-1 HR-1
	HR-1	Go ahead SA-1
	SA-1	Are people focused on the bus area for the kids
		is that what we're doing
	HR-1	That's what we're trying to do
	SA-1	No-one else to help
*	M	What's the ETA on the fire engines SA-1
*	M	Should be there momentarily
12:36:24		
*	M	There's no question where that wind's coming
		from
12:37:07		
		[Breath into microphone]
		[Radio switching noise]
*	M	SA-1 send a unit in before if you got fire
		engines down there put them up here
		immediately
*	M	What was that
*	M	Something about fire engines erm
*	M	[Simultaneous transmission] There's no fire
		engines here at the T
*	M	What'll I say

*	M	Repeat no fire engines at the T
12:38:20		
	HR-2	HR-2 to Forward TOC
	F-TOC	HR-2 go
	HR-2	Be advised that we have six people at the rally
		point in custody at this location we have five
		males one female
	F-TOC	HR-2 we only copied that er last transmission
		five male two female you came in broken all
		the way
	HR-2	Be advised at this location we have six in
		custody five males one female
	F-TOC	Ісору
	E-5	Echo-5 to Forward TOC
	F-TOC	Go ahead
	E-5	Now from our position we can still hear er
		rounds er we're not sure if they're shooting or
		just er cooking off
	F-TOC	We copy that
12:39:29		
*	M	They just cooking off at this point
*	M	We copy that
	Y	Y to TOC
*	M	Looks like two fire engines approaching over
		here at the er
*	M	Yeah
*	M	The triangle
*	M	Yeah
*	Y	Y to TOC

*	Y	Y to T
*	T	This is the T go ahead
*	Y	T are you clearing the fire trucks into your area
		now
*	T	Er 10-4 we'll send it up as soon as it gets here
		okay here come your fire trucks now
12:40:59		
*	M	That tape still going
*	M	Yeah
*	M	Er do you just want to go in and change it now
		Arnie
*	M	Now
*	M	[Simultaneous transmission] Yeah why don't
		you just change it out because there's a lull
*	M	Yeah
*	M	All right
		[Sound of Video tape being ejected]
*	M	You stick another one in
*	M	Yeah
*	M	You got two red lights on both right
12:41:46		
*	M	I see three fire trucks now
*	M	Yeah look there's another two more coming in
*	M	Are there
*	M	Yeah
12:42:24		
*	G-Track	This is Golf-track this Golf-track we have
		numerous rounds exploding in the fire right
		now

*	F-TOC	Forward-TOC to HR-2
*	HR-2	Go ahead Forward TOC
*	F-TOC	A medical control says they've received one
		patient near the second rally are there other
		casualties down there
*	M	Get the fires up to the T we have er one
		casualty at our location
*	M	10-4
*	M	Hold on
*	M	Other individuals in custody I believe there
		might be one casualty forward
*	M	10-4
*	M	Push them down here
*	M	Break all HR units (ATF) advises they have an
		individual on the green side north of the
		compound with a hand gun firing rounds
*	M	That's just great on the green side
		[Sound of firearm being discharged]
*	M	You can hear it
*	M	10-4
*	M	Yeah we'll ask about it
*	M	HR to Falcon unit
*	M	10-4 that was just er call er was arrested
*	M	4
*	F-TOC	Forward TOC to HR-1 did you copy all that
		about the individual out and the handgun
12:49:39		
*	M	That's senseless
	F-TOC	Forward TOC to HR-3

	HR-3	We copy Dave
*	M	Dave where was that guy supposed to be
	F-TOC	Green side just north of the compound
*	M	It should be on this side Arnie right
*	M	Yeah
*	M	Falcon 2 and Falcon 3 your about the gun
*	M	10-4 Falcon units
*	M	That should have been on the end of it
*	M	What we've heard is a er male with a handgun
		on the North side North er off the Green er
		White corner I am sorry off the Green Black
		corner
*	M	Green Black that's over here
*	M	Roger Green Black corner Forward TOC
*	M	That's gonna be the rear
*	M	Yeah
*	G-1	Golf-1 to five do you have any units responding
*	M	Be aware it's their report he has a hand gun er
		Falcon units
*	M	We understand he has a hand gun
12:45:43		
	C-1	Charlie-1 to Forward TOC
	F-TOC	Go ahead Charlie-1
	C-1	Is that individual on the Green Black corner
	F-TOC	Yeah 10-4 that was our last reported position
		just north of the compound
	C-1	They er forming a team over there go ahead-
*	M	looks good

	C-1	-and advise every all the other units so that
		they'll pick us up
*	M	Er 10 9 Charlie-1
	C-1	We're er forming a team over there to try and
		pick him up
*	M	Yeah be advised we got Falcon units out now
		looking for him
*	M	Do you see anything there Arnie
*	M	No
*	M	We see the Falcon units
*	M	Don't see him
*	F-2	Okay this is Falcon-2 go ahead
*	Sierra-2	Sierra-2 Sierra-TOC you've copied all those
		transmissions
	Sierra-TOC	Affirmative we got two birds up scouring the
		area right now looking for him we've had no
		contact
*	M	10-4 and also is gonna be four man er team er
		HR-T operators er in that same area be aware of
		them
*	M	10-4
12:47:12		
*	M	Er this is Sierra-2 we got a visual on the Falcon
		team
*	M	Damn
*	M	9
*	M	Five to Falcon units we're two thousand
		circling above you

*	M	Yes er we don't have a description on er er
		obviously copied once
*	M	Er negative we're just looking for movement
*	M	Be advised we got our guys in the threes just
		beyond the road behind the er lower valley
*	M	Say Andy on the down wind side I got to skid
		the turn so I don't er top it out er when I do that
		just add power
	M	Ok
12:48:11		
*	M	This ain't working down here you're turning
		away turning way inside of
	M	Arnie it's not working can't keep up with it
*	M	Yeah
*	M	Do you want to go back up some
*	M	Yeah go up to 45 and just
*	M	Okay
*	M	Charlie-1 Forward TOC
*	M	Right you got it
	C-1	Charlie-1 to Forward TOC
	F-TOC	Forward TOC go
	C-1	Can you ask that Falcon units if he sees that
		individual on the er Black Green corner by
		the lights as we don't see anything
*	M	Falcon hasn't reported anybody either
*	M	Alright
*	M	Falcon-2 reporting negative at this time
*	M	And 4 5 negative

*	E-1	Er Echo-1 to Charlie-1 be advised we're in the
		sixty position we haven't seen anything from
		this corner
*	M	Er Falcon control is that er the location that I -
*	M	Ok he has American in
*	M	- we didn't see anything when we got here
*	M	Nightstalker is up here looking for him and we
		can't find him
*	M	Falcon er Falcon-2 is going to check the er
		individual vehicles
*	M	There's been no word on the children yet right
*	M	Nope
*	M	Er not since they mentioned the bunker
12:49:48		
*	M	HR is that Charlie
*	M	Forward Charlie
*	M	Go ahead
*	M	Hey listen come over here and let's see if we
		find an entrance underneath into that bus
*	M	Er did someone mention that there was
		something er involving the bus
*	M	(Mike)
*	M	Yes Echo unit at the back of the bus
*	M	Right Echo unit at the back of the bus
*	M	Er 10 9 (you listening)
		[Direct physical microphone contact]
12:54:02		
*	M	Yes Falcon-2
*	M	Who are you talking to

*	Falcon-2	Falcon-2 here negative on the er subject of the
		Green White corner any update on this
*	M	Have not had any update er Falcon-2
*	Falcon-2	White side is negative
12:54:46		
*	M	1 Forward TOC
*	M	Can't hear you
*	M	1 Forward TOC
*	M	Go ahead for Forward TOC
*	M	Anything else but one individual that came out
		right children are also in the area of the buried
		bus I wanna make in that area
*	M	Hold on
*	M	Hey (Yank) you're breaking up badly
*	M	getting around the children maybe near the
		buried bus should find it in the pit area
*	M	I copy the bus but I you're breaking up on the
		last part
*	M	Children may possibly be in the pit area by the
		buried bus
*	M	Medical control from 9 zero
12:55:50		
	HR-2	Forward-TOC it's HR-2 that unit's saying the
		children are in the pit area possibly by the bus
	F-TOC	10-4 and you guys are in that area 10-4
	HR-2	Negative we're at the rally point er transfer that
		to Charlie Echo
*	F-TOC	10-4 break Forward TOC to Charlie and Echo
		information is the children maybe in the pit area

		near the buried bus that's the pit area near the
		buried bus
*	M	This is Charlie we're clearing that now copy
	F-TOC	Copy
		[Radio noise]
12:56:34		
	F-TOC	Forward TOC to er the T are you ready for the
	F-TOC	Forward TOC to HR-1 are you ready for the er
		arrest team to come forward
	T	Er T to Forward TOC
	F-TOC	Go ahead T
	T	We have one white male that's at the T ready to
		picked up er by (ATF) just one white male
	F-TOC	10-4 break Forward-TOC to HR-1
	HR-2	This is er HR-2 for HR-1 he's out on the er
		ground area right at the moment I'll try to er get
		his attention
	F-TOC	10-4
	HR-2	This is HR-2 go ahead and send that (ATF) unit
		forward to (stage)
*	M	10-4
12:57:29		
*	HR-2	HR-2 to Forward-TOC
*	HR-2	HR-2 to Forward TOC
*	F-TOC	Go ahead for HR-2
*	M	I'd be advised all subjects at the T location
		rally area have er burns of varying degrees
		[intermittent transmission] they need treatment

	F-TOC	Yeah Steve er I get er a lot of background I just
		copied er something about subjects at the T
*	M	[in background] right now it's just er
*	M	Yeah warn the T that all subjects at our location
		have er burns of varying degrees
	F-TOC	10-4
	F-TOC	Forward-TOC to T
12:58:32		
	F-TOC	Forward-TOC to T
	T	It's the T go ahead Forward-TOC
	F-TOC	Yeah be advised the subjects that will be
		coming your way from Forward are gonna have
		various degrees of burns
	T	10-4
*	C-1	Charlie -1 to Sierra-1 Alpha
	Sierra-1	Sierra-1 Alph'
*	C-1	Yeah we need a maxi beam over here at the er
		underground bus Green side copy
*	M	Need need what a maxi beam
*	M	10-4
*	M	Is that like a 'Q' beam
*	M	You still want me to stand off Arnie or do you
*	M	to Charlie
*	M	Yeah because it's not a good turn that's for
*	M	[Simultaneous transmission] watch out
*	M	Yeah ok
*	M	We can't keep up with it ok
*	M	[Simultaneous transmission] You need any
		other personnel up there

		[Radio noise]
*	M	
*	M	That's negative all we need is a maxi beam
*	M	10-4 til I get the beam
13:01:12		
		[Radio noise]
	T-1	T-3 this is T-1
	T-3	T-3 go ahead
	T-1	What's it like in your twenty
	T-3	Er well right now I am just an observer er
		should we er begin taking this place apart
	HR-1	HR-1 to HR-2
*	M	3 go to er Whiskey 9
*	M	HR-2
*	M	Unit calling HR-2 go ahead
	HR-1	This is HR-1 how do you read
*	M	Heard you 5 by 5
*	M	Be advised we've got er about er ten units er
		underground in the bunker we're trying to work
		our way er towards the entrance to the school
		bus over
	HR-2	10-4 [intermittent transmission]
*	M	I can't read you er 2
	HR-2	We're ready to shut down the rally point we
		transferred all casualties to the medical people
		do you need additional units up there for
		assistance
*	HR-1	That's affirmative we need shields and we need
		lights copy

13:02:55

*	M	Ісору
	HR-2	I copy lights your second
	HR-1	We need shields shields
	HR-2	10-4
	HR-1	HR-1 to HR-2 would you make sure that er
		someone is up there with those firemen cooling
		down the slab
	HR-2	10-4 they are
	HR-1	Roger
		[Breath into microphone]
	E-1	Echo-1 to Charlie-1
	C-1	Go ahead
*	M	What
	E-1	Er what's your twenty we are just a four men
		team out here
	C-1	We're we're over here er under this under
		ground bus
*	M	Ok need any help
*	M	Er we need some lights and shields
13;03:32		
	G-2	2 to Charlie-1
	G-2	Golf-2 to Charlie-1
	C-1	Go ahead
	G-2	Yeah I get the message and what's your twenty
	C-1	We're in the underground bunker where the bus
		is copy
	G-2	Yeah 10-4 where's the entrance
	C-1	On the Green Black side

	G-2	10-4
		[Radio noise]
13:04:30		
*	M	Well they're out on the slab
*	M	[Simultaneous transmission]
	HR -2	HR- 2 to Forward-TOC
	F-TOC	Forward-TOC to HR-2 Forward-TOC to HR-
		3
	HR-3	HR-3 go ahead
	F-TOC	Yeah we've got we're arranging that those
		maxi beams for er Charlie er is he clear to come
		all the way down or do you want him to stop at
		an intermediate point
13:05:32		
*	M	(David) er I should send
	F-TOC	10-4 he's on his way
	HR-2	HR-2 to 3 Alpha
	3-A	Go ahead 2
*	M	You
*	M	3 to Forward
*	M	Yes so I'd like you to secure
*	M	10-4
*	F-TOC	Forward TOC to HR-3 er we'll bring those er
		beams directly down to the (Abrahms)
*	HR-3	10-4
*	M	Unit to Forward-TOC
*	F-TOC	Go ahead
13:06:14		

*	M	Prisoners being interviewed keep making the children maybe in an underground bunker copy
	F-TOC	We copy children in the underground bunker
13:08:50	HR-1	HR-1 to er
13.00.30	Falcon 2	Er TOC Falcon-2
	TOC	Go ahead Falcon-2
	Falcon 2	Has the er (unsub) other subject er we're
		gonna go and check it out
	TOC	10-4
*	M	We'll stay high until you get out the way you
		going back over to the pasture
*	M	Er we'll go down to the er the pasture down
		at the big (silo) here
*	M	Hey Jim if you copy bring him back here
		we'll wait til the bus comes
*	M	Yeah
*	M	Ray was that for me
*	M	10 22
*	M	Did I hear you say you wanted him back there
*	M	10 22
*	M	Take him on
*	M	Andy you want anything to drink back there
*	M	No I am fine thanks
*	M	Yeah we got cokes and er cokes and er-
*	M	Got it which one
*	M	-Cokes
*	M	Okay [chuckles] got it

*	M	I was a little rushed this morning
*	M	No no that's fine
13:10:24		
*	M	Huh anything you want
		[Radio noise]
*	M	Got to keep above
*	M	OK
	SA-1	SA-1 HR-1
*	M	You want to play with this for awhile
*	M	What's that
*	M	You want to play with it
*	M	Yeah alright
*	M	Let me set it up for you give you the stick
	HR-1	HR-1 to er SA-1
	SA-1	They cleared that er Green side yet
	HR-1	Er they're still in the process er right now
	SA-1	That's fine thank you
*	M	Er HR-2 if you guys are wetting down the
		area where the bus is we're about to make our
		way through the tunnel at this time
*	M	Wow look at the way the slab is-
*	M	Ok
*	M	-different colours with them wetting it
*	M	Yeah
*	M	Just keep it on that spot that's turning black
		there Steve
*	M	All right
	G-2	Golf-2 to Golf-1
	G-1	This is Golf-1

*	M	Now watch this slab that
	G-2	Yeah can we get a up there
*	M	[Simultaneous transmission] and er where a
		new construction was gonna go
*	M	Right
*	M	And supposedly under is the bunker or
		something like that
*	M	Just to the top of the screen of the
*	M	Okay
*	M	10 – 9 er repeat last transmission for Golf-4
*	M	[Simultaneous transmission] yeah they had the
		bus buried cos they were allegedly using it for a
		bunker
*	M	Arnie did you hear er confirm that the kids
		were in there that they were
*	M	No they just they er through interrogations
		everybody is saying they could possibly be in
		the bunker they haven't confirmed it yet
		though
13:14:10		
*	M	I am surprised there aren't any news choppers
		around
*	M	[Simultaneous transmission] Golf-2
*	M	Any choppers where
*	M	There isn't any news helicopters out yet
*	M	Oh they can't get in it
*	M	Yeah I know but they could at least-
*	M	[Simultaneous speech] Do you mean
*	M	-stay on the outside of the five miles

*	M	Yeah but that five miles goes all the way over
	141	to er TSTC yeah you notice er they
		couldn't even get over TSTC this morning I
		believe
	N	
10.14.55	M	Yeah that's true too
13:14:57		
	F-TOC	Forward TOC to the T
	T	Go ahead F-TOC
	F-TOC	This is the Forward TOC can you er give us the
		number of er prisoners
	F-TOC	Forward TOC to er the T
	T	T go ahead
	F-TOC	Yeah can you give us a number of individuals
		in custody uninjured
	T	10-4 standby
13:16:52		
*	M	You want to do some circles your way
*	M	Things have er settled down here
*	M	Hey Steve we gonna do a course er reversal
*	M	Okay
*	M	2 Forward TOC
	F-TOC	This is the Forward TOC go ahead
*	M	Yeah tell them er two uninjured so far
		however we got several of them er various
		stages of
	F-TOC	10-4 just let us know when you got a total
		number and er etcetera thanks
13:17:51		
	F-TOC	Forward-TOC to er units er near the bus

Transcript FLIR Q5

	T	T to the Forward-TOC
	F-TOC	This is Forward-TOC go ahead
T	We got a total of eigh	t people injured and uninjured total of eight at
		this point
	F-TOC	Forward-TOC to er Charlie or er Echo
	G-34	It's Golf 34 to Forward TOC
	F-TOC	Go ahead for Forward TOC
	G-34	This is Golf 34 the bus has been cleared I
		repeat bus is clear nobody's in the bus they're
		moving on
	F-TOC	That's clear
*	M	Oh nobody in the bus
13:19:40		
*	M	Okay here you go I've got the power
*	M	Okay alright now
*	M	And your trim let me go through the trim
		switches here you got rudder trim
*	M	Yep
*	M	Ah pitch trim and this is er spoiler trim right
		here
*	M	Okay
*	M	And if if you're holding too much pressure er
		take to the left you trim left
*	M	Okay
*	M	Whichever is the downside is the way you turn
		your knob
*	M	Got it
*	M	And you can't do just the visual now you gotta
		pay attention to the needle

*	M	Okay I don't know how that works
*	M	Okay now I'll try and explain those to you but
		er we can't let that needle get any higher than a
		zero otherwise we top out the sensor
*	M	Okay so how
*	M	So you need to position the aircraft if you
		think of it in terms of like er flying a er DME
*	M	Okay
*	M	Er this points to the Nav station right here
*	M	Okay
*	M	Hey Steve
*	M	Yeah
*	M	Kick the er record audio off
13:20:32		[Audio off]
13:39:07		[Video off]

Aservice i Linköping Orlunda Agro & IT SWEDEN

WACO INVESTIGATION: IMAGE ANALYSIS AND VIDEO AUTHENTICATION

October 4 2000

Mrs. Lena KLASÉN Orlunda Agro & IT Skänninge, SWEDEN

Mr. Sten MADSEN Aservice i Linköping Linköping, SWEDEN

EXECUTIVE SUMMARY

The Office of Special Counsel, St. Louis, Missouri, U.S., was established to investigate the events that occurred at the Mt. Carmel complex on April 19, 1993, in Waco, Texas. As one part of the investigation, the Office of Special Counsel retained Mrs. Lena Klasén and Mr. Sten Madsen to perform image analysis and video authentication of the videotapes taken by the FBI Nightstalker surveillance aircraft on April 19, 1993. Mrs. Lena Klasén and Mr. Sten Madsen were retained January 13, 2000. This Executive Summary presents the results from an investigation of the flashes seen on the FLIR videotapes and the results from the FLIR video authentication, as requested by the Office of Special Counsel.

Image Analysis

Dr. Edward Allard, an expert for the Branch Davidians, initially compiled a list of questioned events or "flashes." Vector Data Systems (U.K.) Ltd., experts for the Office of Special Counsel later investigated this list. The Maryland Advanced Development Laboratory, experts for the U.S. government, have also investigated the list associated with Dr. Allard's declarations. The list of thermal events created by Vector Data Systems was provided to this investigation in February 2000 by the Office of Special Counsel, and served as a basis for the list used in this investigation. Vector Data Systems' list of flashes was updated within this investigation when appropriate.

In order to determine the cause of the flashes, a sophisticated computer hard and software systems solution was set up to analyze the FLIR imagery. The key issue to this investigation has been maintenance of the image quality and limitation of further degradation.

The technical approach for this investigation was to enhance the FLIR imagery in the area surrounding each questioned event. These enhancements were made to determine if any movement could be detected in relation to each flash. When moving objects were identified proximate to a flash, analytical methods were employed to determine whether the movement was human in form or nature. There is however no evidence of human movements in the area surrounding the flashes. There was, however, a lot of moving debris.

In the initial phase of the investigation it was discovered that several of the flashes appeared at fixed positions and on a regular basis. The timing of the flashes agreed with the FBI Nightstalker's circular movements over the Branch Davidian complex. This strongly suggested that the majority of the questioned events were caused by solar reflections. To confirm this hypothesis the reflection geometry of the day in question was reconstructed utilizing a 3D model based on the physical laws of reflection. The 3D model incorporated the positions of the Branch Davidian complex, the sun and the FBI Nightstalker. Based upon the striking correlation of the theoretical model and physical laws of reflection in comparison to the reconstructed geometry, it is concluded that the majority of the flashes were caused by solar specular reflections.

Four flashes of a pulsating nature could not be explained to be solar specular reflections from only the reconstructed data. To find the cause of these flashes, the imaging system itself was reviewed. Sophisticated and complex imaging technologies are not perfect. Imaging systems can create physical, electronic and mechanical phenomena, which were believed to cause undesired image artifacts and to affect the representation of small objects on the FLIR videotapes from April 19, 1993. To verify this assumption, the core of the FBI Nightstalker, the infrared SPRITE/TED detector elements and scanning mechanisms, were carefully studied. The interlaced video format used for recording the FLIR imagery was also studied carefully. The results from these studies confirmed the hypothesis that small objects cannot be assumed to be correctly represented on the FLIR videotapes. The Fort Hood flight trials were analyzed, as well, and pulsating flashes from reflecting debris were detected, similar to the flashes on the FLIR videotape from April 19, 1993. Based of the results from these examinations it is concluded that the remaining questioned flashes are reflections caused by solar or heat reflections, from single or multiple objects, subsequently distorted by the SPRITE/TED detectors and scanning mechanisms or the interlaced video format. Most likely there were complex combinations of these phenomena.

Many contradictory opinions exist as to the cause of the flashes seen on the FLIR videotape from April 19, 1993. Dr. Allard and Maurice Cox, among others, conclude that the flashes are gunfire. They also concluded that the FBI Nightstalker FLIR could not possibly record solar reflections. Dr. Allard stated "nothing in nature could do this" regarding the pulsating nature of thermal signatures. Mr. Allard and Mr. Cox's gunfire hypothesis is not only based on wrongful assumptions, but it also suffers from neglecting several important scientific parameters. For instance, (a) neglecting the FLIR sensor characteristics and scanning mechanisms, (b) impacts of the interlaced format of the video standard, (c) wrongful assumptions regarding solar reflections, (d) wrongful assumptions regarding the FBI Nightstalker aircraft ground speed and its position relative to the Branch Davidian complex. These factors have contributed to their misinterpretation of the flashes seen on the FLIR videotapes from April 19, 1993.

The Maryland Advanced Development Laboratory determined the flashes on the April 19, 1993, FLIR videotape, were too long to be muzzle blasts and instead were caused by a phenomena other than small-arm fire. The Maryland Advanced Development Laboratory further detected and proved solar specular reflections to be apparent on a watery surface. Their conclusions give a much more accurate and viable explanation for the flashes recorded on the FLIR imagery from April 19, 1993.

There are phenomena, unrelated to gunfire, that can cause flashes such as those seen on the April 19, 1993, FLIR videotapes. Solar reflections normally make little contribution in the thermal band in which the FBI Nightstalker surveillance system operated, but they are possible. The results of this investigation have proven that specular solar reflections do appear on the FLIR videotapes from April 19, 1993, between 10:41 a.m. - 12:16 p.m. The large amount of glass from broken windows and reflective debris from the demolished complex are believed to have contributed in a significant increase of the probability of specular solar reflections.

It is concluded with a confident level of certainty that all of the analyzed flashes seen on the FLIR videotapes from April 19, 1993, between 10:41 a.m. - 12:16 p.m., are caused by solar or heat reflections from single or multiple objects. The characteristics of the SPRITE/TED detectors and scanning mechanisms and the interlaced video format are factors that have contributed to distort the appearance of the flashes on the April 19, 1993, FLIR videotapes. Moreover, no humans were detected on the FLIR videotapes in any area in the vicinity of any of the flashes, only moving debris. The results from this investigation have shown, with a confident level of certainty, that the flashes on the FLIR videotapes from April 19, 1993, between 10:41 a.m. - 12:16 p.m., cannot form evidence of gunfire.

Originality and Authenticity of FLIR videotapes

The methods selected to investigate the originality and authenticity of FLIR videotapes Q-1, Q-2, Q-3, Q-4, Q-5, Q-6 and Q-7 were based on the characteristics of the electrical signals on the FLIR videotapes. The fact is, video machines leave individual and detectable traces on the videotape during recording. These traces can be measured and the measurements are like a fingerprint for a video machine. By analyzing these traces it can be determined whether a recordings has been interrupted, tampered with, erased, altered or recorded over. The following electrical signatures have been analyzed on the April 19, 1993, FLIR videotapes; RF-envelope for video signal, RF-signal carrier frequency for video signal, RF-envelope for FM-audio signal, dihedral error measurements and CTL-pulses.

Based on the analysis of the FLIR videotapes it is concluded, with a confident level of certainty, that only FLIR videotapes Q-1-Q-5 are original recordings, in the sense that recorded portions are master recordings directly from the source, the FLIR sensor.

FLIR videotape Q-1 has at least three previous recordings found in the beginning of the tape, which all three have been over recorded. The recording made at 05:58:11-08:00:02 on April 19, 1993, is an original recording with no signs of edit or erasure on the recorded portion.

FLIR videotape Q-2 is an original recording with no signs of edit or erasure to the recorded portion.

FLIR videotape Q-3 is an original recording with no signs of edit or erasure to the recorded portion.

FLIR videotape Q-4 is an original recording with no signs of edit or erasure to the recorded portions. Although the recording is interrupted between 10:47:16 and 10:51:57, there is no sign that this portion of the tape was edited or erased.

FLIR videotape Q-5 is an original recording with no signs of edit or erasure to the recorded

portion.

FLIR videotape Q-6 is a first generation copy from an original master. There is no sign that the FLIR imagery has been edited. The master for this recording is not FLIR videotape Q-1-Q-5.

FLIR videotape Q-7 is a first generation copy from an original master. Although the video sequence is interrupted between 10:47:15 and 10:51:57, there is no sign that this interruption in the recording is an edit point. There is no sign that any other part of the FLIR imagery has been edited or erased. The master for this recording is not FLIR videotape Q-1-Q-5.

It is also concluded, with a confident level of certainty, that FLIR videotapes Q-1-Q-5, are original recordings. There is no sign that the recorded portions on FLIR videotapes Q-1-Q-5 have been edited or erased after they were produced. It is concluded, with a confident level of certainty that the interrupt on FLIR videotape Q-4, between 10:47:16 and 10:51:57, was not created afterwards but during the time of recording. It is also concluded, with a confident level of certainty, that FLIR videotapes Q-6-Q-7, are copies.

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1. INTRODUCTION

In September 1999, the Attorney General of the United States appointed former United States Senator John C. Danforth to investigate the events at the Branch Davidian complex in Waco, Texas, 1993. Special Counsel Danforth established the Office of Special Counsel to carry out the investigation. As one part of the investigation, the Office of Special Counsel retained Mrs. Lena Klasén and Mr. Sten Madsen to perform image analysis and video authentication of the videotapes taken by the Federal Bureau of Investigation (FBI) Nightstalker surveillance aircraft on April 19, 1993. Mrs. Lena Klasén and Mr. Sten Madsen were retained January 13, 2000.

Based on her experience with defense reconnaissance applications, forensic casework and research on three-dimensional (3D) reconstruction of human shape and motion from video, the Office of Special Counsel asked Mrs. Lena Klasén to analyze the "flashes" on the FLIR videotapes, recorded April 19, 1993. Based on his vast experience with a variety of video technologies and forensic casework, the Office of Special Counsel asked Mr. Sten Madsen to investigate the originality and authenticity of the video track on each of the seven FLIR videotapes from April 19, 1993. Mrs. Klasén and Mr. Madsen have not been under a contract with the U.S. Government before this assignment. Neither have they been involved with any investigation of the events at the Branch Davidian complex in Waco, Texas, 1993, prior to this engagement. Mrs. Klasén's and Mr. Madsen's biographies are attached hereto as appendix 1.

1.1 Background

During the stand off the FBI Nightstalker FLIR imaging system recorded several videotapes of the Branch Davidian complex. According to information that was provided by the Office of Special Counsel, the FBI Nightstalker used April 19, 1993, was equipped with a Sea Owl long-range infrared (IR) imaging system. This Sea Owl long-range imaging system had as its core a SPRITE/TED IR detector. Thermal images from the FBI Nightstalker FLIR were simultaneously recorded onto VHS videotapes on April 19, 1993, FLIR videotapes Q-1 – Q-5. The masters for recordings Q-6 and Q-7 were also recorded on April 19, 1993.

The Branch Davidian complex appears on the FLIR imagery from a variety of viewing angles and distances as the FBI Nightstalker circled above the complex during surveillance. Conventional photos were also taken on April 19, 1993, from both aerial and ground views. Media covering the standoff also made video recordings of the events from morning to afternoon. Figure 1.1 is an image from FLIR videotape Q-4, a duplicate aerial color photo and a simplistic three-dimensional (3D) model from similar views. Figure 1.1 also illustrates the directional color-coding of the Branch Davidian complex used by the FBI, which will be referred to in this report.

This report describes the source data, the technical approach to the investigation, investigation procedures, results and conclusions.



Figure 1.1. A FLIR image (left), a duplicate photo (middle) and a simplistic 3D-reconstruction model of the Branch Davidian complex based on GPS stake coordinates (right), distances in meter [m].

1.2 Outline of Investigation

The Office of Special Counsel requested the following be determined: (1) the cause of the questioned events (also denoted as flashes or pulsating flashes) on FLIR videotape Q-4; (2) whether FLIR videotapes Q-1 – Q-7 are original and authentic; and (3) the location of any heat signatures associated with the start of the fire inside the Branch Davidian complex. After initial reviewing of the FLIR imagery and discussions with the Office of Special Counsel the tasks agreed upon were:

- to enhance image sequences from the FLIR videotapes and analyze the flashes seen on the FLIR videotape Q-4;
- to determine whether any persons appear on FLIR videotape Q-4 and to track and analyze their movements:
- to analyze the flashes on FLIR videotape Q-4 by reconstructing the geometrical relations of the Branch Davidian complex, sun and the FLIR sensor;
- to provide measurements and enhanced images for the fire development investigation;
- to determine if the FLIR videotapes are original recordings; and
- to determine if the FLIR videotapes have been edited or technically altered in any way.

Image processing for the fire investigation has been carried out in cooperation with Professor Ulf Wickström, SP, Swedish National Testing and Research Institute, an expert of the Office of Special Counsel, who received processed data from this investigation. Authentication of the FLIR video has been done in cooperation with Chris Mills, Network International Forensic Science Division, an expert of the Office of Special Counsel who analyzed the authenticity of the audio tracks on the FLIR videotapes.

2. INVESTIGATION MATERIAL

The Office of Special Counsel provided the source of data for this investigation. Appendix 2 contains a complete list of all material received. In this case only videotape Q-1-Q-5 are original recordings, see chapter 6, which is why FLIR videotapes Q-1-Q-5 provided the primary source of data in this investigation. Copy videotapes and duplicate imagery have been used as complementary source data rather than evidential images. Additional reference literature referred to in this investigation are included in the list of references at the end of this report.

2.1 Videotapes

FLIR videotapes Q-1-Q-7, detailed in table 1, were made available for this investigation from February 29, 2000 to March 29, 2000. FLIR videotapes Q-1-Q-7 are all in VHS format. FLIR videotapes Q-1 to Q-5 are original master recordings, while Q-6 and Q-7 are first order generation copies from original masters, see chapter 6.

Reference	Notes and some of the text from cassette-labels	Time Information, Recorded Portions
FLIR	Videotape Q-1, VHS	05:58:11-08:00:02
videotape Q-1	"Nightstalker - 4/19/93 Tape#1 -5:57 Am-8:00 Am Q-1"	
FLIR	Videotape Q-2, VHS	07:57:42-09:28:20
videotape Q-2	"Nightstalker - 4/19/93 Tape #2 7:57A-9:30 AM Q-2"	
FLIR	Videotape Q-3, VHS	05:58:09-07:57:00
videotape Q-3	"Q-3 Nightstalker 4/19/93 Tape #1 -5:57AM-7:57AM"	
FLIR	Videotape Q-4, VHS	10:41:57-12:16:13
videotape Q-4	"Tape 1 ORIGINAL 4/19/93 appx 1:30 Q-4"	
FLIR	Videotape Q-5, VHS	12:16:37-13:39:07
videotape Q-5	"4/19/93 Tape II Waco ORIGINAL appx 45 min Q-5"	
FLIR	Videotape Q-6, VHS	12:41:25-14:01:38
videotape Q-6	"Tape #16 FBI aerial infra-red recording of Mt.	
	Carmel's Branch Davidian Compound on 4/19/93,	
	12:41 p.m. through 2:01 p.m. (2 of 2). Elsur #1B-319"	
FLIR	Videotape Q-7, VHS	10:41:56-12:41:07
videotape Q-7	"Tape #15 FBI aerial infra-red recording of Mt.	
	Carmel's Branch Davidian Compound on 4/19/93,	
	10:41 a.m. through 12:41 p.m. (1 of 2). Elsur #1B-319"	

Table 1. FLIR videotapes Q-1-Q-7.

The Office of Special Counsel also provided copies of the April 19, 1993, FLIR videotapes (app. 2, items 8-11), one FLIR videotape recorded at the Branch Davidian complex on March 26, 1993, (app. 2, item 12), videotapes of major news footage (app. 2, items 13-14), a videotape concerning solar reflections in the far IR spectrum presented by the Maryland Advanced Development Laboratory (app. 2, item 15) and videotapes from the Fort Hood flight trials March 19, 2000, (app. 2, items16-26). All videotapes (app. 2, items 8-26) were in VHS format and were copies.

2.2 Digital Images, Photos and Duplicate Photos

The Office of Special Counsel also provided digital images of the complex before and during April 19, 1993, (app. 2, items 27-34). A hard disk with digitized video (app. 2, items 35), as well as requested primary FLIR images with temperature data from the flight trials at Fort Hood (app. 2, items 36) were received. All of the digital images of the Branch Davidian complex were, however, digitized from photos or reproductions from duplicates and were stored in compressed image formats. The negatives were unavailable to this investigation. Duplicate photos of the complex (app. 2, items 42-43) and photos of the Fort Hood trial site (app. 2, items 37-41) were further provided. The photos from the flight trials (app. 2, items 37-41) were produced directly from the negatives.

2.3 Maps and Drawings

Maps and drawings of the complex, both as paper copies (app. 2, items 44-49 and 52), stake positions of Mount Carmel complex (app. 2, item 50) and CAD data (app. 2, item 51) were requested and provided by the Office of Special Counsel.

2.4 Reports and Related Literature

The Office of Special Counsel provided expert reports for information and review (app. 2, items 53-65). Experts prepared these reports for the Branch Davidian, the U.S. Government and the Office of Special Counsel and concerned issues relevant to this investigation. Each of these reports was reviewed and a summary of the review is included in chapter 7.

Requested, and also provided by the Office of Special Counsel, were a summary of the NIIRS rating scale (app. 2, item 66), an abbreviated summary of the FBI Nightstalker FLIR system platform data (app. 2, item 67), the protocol for the Fort Hood flight trial (app. 2, item 68), a copy of the FBI Nightstalker aircraft handbook (app. 2, item 69) and audio transcripts of the April 19, 1993, FLIR videotapes (app. 2, item 70). A summary of public statements made by experts regarding the flashes seen on FLIR videotape Q-4 and the copy Q-6 (app. 2, item 71) were also provided.

2.5 Miscellaneous

Other data requested for the investigation were climatic information and daily weather reports for April 19, 1993, (app. 2, item 72), and March 18-19, 2000, (app. 2, item 73). An early and abbreviated version of the Vector Data Systems' (U.K.) Ltd. master event list was also received from Vector Data Systems, (app. 2, item 74).

3. TECHNICAL APPROACH

It is important to clarify the parameters that were considered important for analyzing the FLIR videotapes.

The FBI Nightstalker FLIR system generated thermal images of wavelength 8-13 μ m, outside the visible range of human biological vision, which is 0.4-0.7 μ m. CCD images and conventional photos are images captured within the range of our biological vision. As infrared (IR) wavelengths are captured outside our visual range, a thermal image can be defined as an image captured by an infrared detector and converted into a visual image by a thermal imaging system. The detector elements in the thermal imaging system convert infrared radiation into an electrical signal, which further is converted into a video signal that can be recorded and displayed.

Thermal images make the light naturally emitted by an object visible based on temperature differences rather than absolute temperatures. The temperature difference, in turn, depends on the objects energy exchange with the environment, self-heating, emissivity differences or reflections of other sources. Emissivity is explained as the magnitude of radiated thermal energy from a surface as a function of the surface property. Mathematical models that describe in detail how this radiated thermal energy is converted in the imaging system are well described in the literature. See [Fraden] and [Cuthbertson]. The advantage of a thermal imaging system is the ability to expand the human visual range into the infrared region. For example, thermal imaging can provide night vision. Another advantage is the ability to detect, track and recognize objects at a long range, provided a resolvable temperature difference relative to the background is available.

Thermal images cannot be directly compared to images taken directly in our visual range as the inputs from the real world are different. One major factor is the use of temperature differences instead of illumination in thermal imaging. In practice, this difference can cause hot water and cold water to look different on a thermal image, but on a conventional photo it will appear the same. Further explanations and illustrations of the differences are found in [HolstIR], [HolstCCD] and [Cuthbertson], but also in (app. 2 item 65) and in appendix C in (app. 2 item 58). Neglecting the significant difference in thermal images compared to CCD images and conventional photos can lead to unrealistic conclusions about what can be seen on the FLIR videotapes.

As "nothing is as good as the original" regarding imaging technologies in forensic applications, analyzing a low quality image requires specific methods to avoid further degradation in all phases of the investigation. This has been a key issue for this investigation. Signal-to-noise ratio (SNR) can be a useful measure of image quality degradations caused by a particular system or sub-system. Variations in image quality can originate, for example, from the varying performance of video recorders, video systems, equipment used to digitize and display the video, computer frame grabbers, image format, monitors, projectors and computer screens. Each of these systems will introduce some kind of degradation to the

image. Literatures on the subject are [HolstIR] and [HolstCCD] who discuss some of these variations.

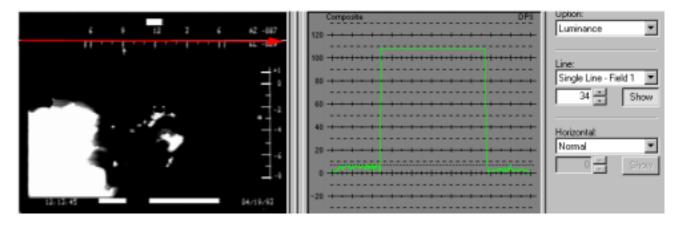


Figure 3.1. Signal levels in percentage (right image) measured at the red horizontal arrow in the FLIR image (left image).

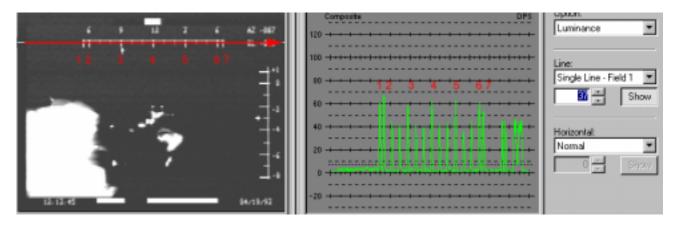


Figure 3.2. Variations between perceived visual information at the red horizontal arrow in the FLIR image (left image) and corresponding measured signal levels in percentage (right image).

Degradation of image quality had already been induced during recording of the FLIR videotapes. Figures 3.1 and 3.2 are images from FLIR videotape Q-4. The measurements are from an examination of the video signal levels before the FLIR videotapes were digitized. The AZ-presentation in the FLIR images indicates the azimuth angle of the FLIR sensor relative to the FBI Nightstalker aircraft. The video level on the FLIR videotapes was adjusted by using the video signal level of the AZ-presentation as a reference level. The white-level of the horizontal part in the AZ presentation became saturated at 109 %, measured by the system's built in waveform monitor. This corresponded to a pixel value of 255 in an 8-bit grey scale image, figure 3.1. In practice, this means that what we clearly perceive as "white" also remained "white" in the digitized images and that the image quality was maintained as desired. Figures

3.1 and 3.2 indicate two different kinds of problems; image degradation by the video format; and the difference between perceived and measured image information.

First, bandwidth limitations of the video format used when recording the FLIR videotapes degrades the recorded signal levels. Problems occur during rapid changes between "black" and "white," as an effect of the bandwidth limitations for the video format. This affects the representation of small objects. Figure 3.2 reveals this kind of degradation in the horizontal direction of small details, as the vertical parts of the AZ presentation, seen in figure 3.2, were limited to a maximum level (estimated to $\approx 65\%$) instead of "white" that was calibrated to 109%.

Secondly, there is a significant difference in how the human visual system perceives and processes visual information, compared to computer aided image analysis. The human visual system has the ability to process visual information beyond the capacity of today's computer vision methods. One example is the human eye's ability to deal with invariance caused by the varying scale of an item or changes in lighting conditions. This is a complex task to implement. In fact, it is so difficult that it is the subject of numerous ongoing research projects. There are, however, some weak points in our biological visual system. An example is our limited ability to resolve small quantitative differences, such as minor changes in contrast or in the size of an object. Computers can be used to assist the eye in making quantitative assessments. Computer based algorithms provides a consistent review of an image, compared to variations in each individual's ability to resolve small variations. The difference between visually perceived information and measured signal levels are illustrated in figure 3.2. The vertical bars (measured video signal level <65%) of the AZ-presentation appear the same "white" to the human eye as the horizontal bar (measured video signal level 109%). However, the measured video signal level shows a significant difference.

The use of image compression techniques can also introduce unwanted artifacts that can change the texture and geometrical shape of an object within an image. Normally we cannot see these data artifacts, but the introduction of these data artifacts can affect the integrity of the original image and threaten its reliability for forensic examination.

At this time and to the author's best knowledge, there is no formal standard for the use of evidential images. An overview of image analytical methods in criminal justice systems is presented in [Klasén], in which the urgent need for standardized forensic image procedures also is discussed. The Scientific Group on Imaging Technologies, [SWGIT], presented recommendations and guidelines in April 1999. In both documents it is suggested that original images and images to undergo image analysis, should not undergo "lossy" compression or other kinds of processing or copying that would case degradation to the original image. For this investigation, these general recommendations have been followed.

It is necessary to have knowledge of <u>all</u> phases of the imaging process and the behavior of the system components within the imaging system. The reason for this is to be aware of how objects in the

real world are represented and where the information from the real world might be degraded by the system's components. Examples of such components are the system's optics, detector elements, system electronics, storage media, digitizing procedures, computer based algorithms, display units, printers and the abilities of the system's operators. These factors all need consideration during any forensic examination. Imaging technologies are designed to achieve an optimal image quality, but features like noise patterns and deviations in signal-levels are often the key issues in forensic investigations.

The technical approach for this investigation was to first analyze the FLIR sensing system and, in particular, its SPRITE/TED detector. Some typical fixed pattern noise induced by the scanning mechanisms, among other factors, was immediately detected and recognized on the FLIR imagery. The results from this examination proved valuable in the digitizing process, noise reduction and for estimating the tracking error in the 3D reconstruction. The findings of the systems examination were also quite important to explain why small objects cannot be trusted to be correctly represented in the thermal images from the FLIR system.

The next step was to analyze the FLIR videotapes in depth. Because analyzing evidential images often means extracting information that is not directly obvious to our eyes and brain, image enhancement methods were used to provide images that were easier to interpret. Various analytical methods were used to provide complementary numerical values, such as the position of a flash or the FLIR sensor position. The main focus of this part of the investigation was to reconstruct the flash geometry. This work has been performed with awareness to the generic problems of detecting small objects, false detection, and the specific imperfections of the FBI Nightstalker's long-range thermal imaging system used on the April 19, 1993.

The electrical signals stored on the FLIR videotapes were successfully used to authenticate the April 19, 1993, FLIR recordings. Video machines leave individual and detectable traces on the videotape during recording. To determine if the recordings were interrupted, tampered with, erased, altered or recorded over, the following electrical signatures were analyzed; RF-envelope for video signal, RF-signal carrier frequency for video signal, RF-envelope for FM-audio signal, RF-signal carrier frequency for FM-audio signal, dihedral error measurements and control pulses (CTL- pulses).

4. IMAGING

The system used to digitize and analyze the recorded images on the April 19, 1993, FLIR videotapes utilized dpsReality/Velocity software and a frame grabber processing board. This was hosted in an Intel Pentium PC with a Windows NT 4.0 operating system. Data was stored uncompressed on an IBM SCSI raid disc with a capacity of 226 Gb. Seven additional IDE discs, of 20 to 26 Gb storage capacities were used for uncompressed storage of the remaining digitized video.

In order to digitize and store such a large amount of data, while retaining as much as the image quality as possible, analogue measurements and system tests were performed prior to digitizing. This was an important phase in the video authentication investigation, as deviations in measured values are also useful to trace technical tampering. Significant effort was put into creating sequences to be used for image enhancements. As a result, the FLIR videotapes were digitized at three different levels of the available video signal.

First, the dpsReality/Velocity systems default settings were used to maintain the FLIR videotapes' dynamic range. System defaults in this case resulted in some bit reduction. As the graphical presentations in the FLIR image peripherals were of slightly higher intensity than the saturation level by the FLIR sensor, this bit reduction was not critical. When digitizing the video signal, the white-level of the horizontal part in the AZ presentation, figure 3.1, was used as reference as this was the highest video signal level. This was set to correspond to pixel value 255 in an 8-bit grey scale image, which also corresponds to the cut of level of the system used for this investigation. Loss of single frames was only detected on three occasions, a rate that was considered small enough to be neglected considering the large amount of frames.

Secondly, interesting sequences from FLIR videotape Q-4 were digitized, with the dynamic range in low contrast areas stretched before digitizing. This saturated the upper and lower parts of the dynamic range. In this way, a significant enhancement of the contrast for the middle grey levels was achieved. These sequences were specifically designed to search for persons or other objects of very low contrast relative to the background and proximate to the flashes.

Third, several sequences from FLIR videotape Q-4 were digitized multiple times in the same manner to be used for noise reduction.

All of FLIR videotape Q-4 was digitized. Selected sequences from FLIR videotapes Q-1, Q-2 and Q-5 were also digitized. FLIR videotape Q-3 was omitted as the content and quality were similar to FLIR videotape Q-1. FLIR videotapes Q-6 and Q-7 were not used since they were first generation copies. In total, approximately 3 hours of video from the FLIR videotapes were digitized, which still left space on the system for temporary storage of processed sequences.

Each video frame was captured and stored in uncompressed YUV format. In this case it was unnecessary to use images of size 720 x 486 x 24 bit, as there is no color information on the FLIR videotapes to necessitate the use of 24 bit for color depth. However, there were many advantages with this system solution. For instance, it was a commercially available product with support facilities. A major functionality was that the system allowed access to stored images directly by other image analysis software, on arbitrary image formats and within very reasonable access times. The system also provided export facilities for different image formats. The system provided functions to view and export images at arbitrary speed and direction, either in frame or field mode. Images in BMP format were used throughout the investigation to avoid compression. For the three-dimensional reconstruction TGA images were needed, as BMP files were not accepted by the reconstruction software. ACDSee software was used to convert uncompressed BMP files to TGA, as the RLE compression option could be disabled for TGA files. No external image stabilization equipment beside the frame grabber was included in the system.

For image analysis Matlab by the MathWorks Inc. was used for benchmarking, measuring, mathematical calculations and for data visualization. Cognitech Video Investigator was used for image enhancement. MatchMover by Realviz was used for 3D reconstruction. ACDSee by ACD Systems Ltd. was used for viewing and image format conversions.

A 150 MHz, 4-channel Gould 3150 oscilloscope, a frequency counter, the dpsReality's built in waveform monitor and an external Leader LBO 5861 waveform monitor were all used for benchmarking and for accurate measurements of electrical signals from the FLIR videotapes. SONY PVM 1371 and Croma Monitor CM 151 video monitors and a variety of video projectors were used for viewing. JVC BP 5300EP and Panasonic AG 6200 video machines were also used, since these particular types of older video machines do not create or add any undesired signal processing to the final output. A Panasonic NV-W1E video machine was used to analyze the audio hi-fi tracks. A Panasonic alignment tape was used as a reference to calibrate the video machine. The built in oscilloscope in the dpsReality software was also used for benchmarking and monitoring the video signal.

5. IMAGE ANALYSIS

The first task was to enhance the sequences that included the flashes seen on the original FLIR videotape Q-4. Enhancements were achieved by applying image processing methods to deal with the various image distortions. The aim was to extract whatever visible information existed within the FLIR imagery. The FBI Nightstalker FLIR system not only created infrared video recordings, it also added a complex combination of noise and blur to the recorded images. As the characteristics of the FBI Nightstalker FLIR system have had a significant impact on the image quality, the FLIR imaging system itself needed to be investigated, section 5.1. Software specialized for investigative video processing was used to reduce and compensate for this noise and blur, see section 5.2. This software also provided techniques to achieve high-resolution images from FLIR videotape Q-4 based on "frame fusion for super-resolution".

In the case of alleged gunfire, it is reasonable to assume that persons would have to be present to fire the subject weapons. After a careful analysis of the areas surrounding the questioned events and careful tracking of movements of any type of objects near the flashes, it was concluded that no human type movement or activity occurred near any of the flashes on the April 19, 1993, FLIR videotape Q-4, see section 5.3.

In an early stage of the investigation it was discovered that the appearance of the flashes could actually be predicted. For example, some flashes on the single-story roof of the Branch Davidian complex occurred approximately every two minutes, figure 5.1. These flashes also occurred when the same part of the complex was in the FLIR sensor field of view and the FBI Nightstalker was in a similar position relative to the complex.

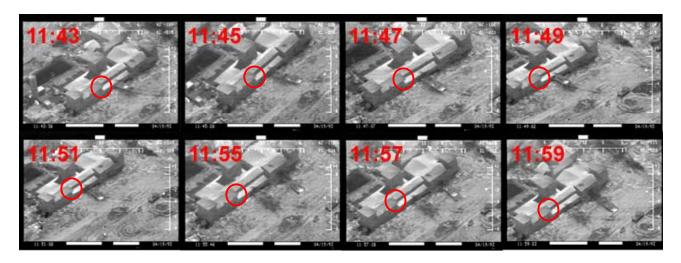


Figure 5.1. Regular appearance of flashes from the same part of the single story roof at 11:43:36, 11:45:20, at 11:47:07 the roof was partially clouded and a flash only faintly visible, at 11:49:02,

11:51:00, 11:55:46, 11:57:26 and 11:59:03. At 11:53 no reflection was detected. At 12:01 and 12:03 the single story roof was only partially seen in the FLIR images. At 12:05:15 a flash appeared again from this same part of the single story roof.

"Two-minute turns" are commonly used in aviation. From the FLIR imagery it was clearly seen that one turn of the FBI Nightstalker takes about two minutes to complete. See for example figure 5.1. On April 19, 1993, the FBI Nightstalker's pilot probably flew so the operator could keep the complex in the FLIR sensor's field of view. In all probability this caused the pilot to fly under visual flight rules (VFR). Variations in the FBI Nightstalker's flight path were believed to have been caused by the strong wind, which made the aircraft drift relative to the complex. As the flight path played an important role during recording of the FLIR videotapes, the first task was to investigate the various positions of the FBI Nightstalker and thereby the FLIR sensor, section 5.4.

It was discovered that the flashes seemed fixed in position relative to the complex. Based on the predictable nature of the flashes, it was decided to reconstruct the flash geometry in order to confirm the hypothesis that the flashes were reflections from glass or other kind of debris, section 5.5. Reconstructing the geometry for the flashes in table 2 became the main focus of this investigation due to the characteristics of the flashes, the results from the image enhancement and the lack of persons proximate to any of the analyzed events.

A three-dimensional (3D) reflection model based on the physical laws of reflection formed the basis for the reconstruction of the flash geometry. Essential parameters included the position of the complex, the position of the sun and the FBI Nightstalker's flight path from which the FLIR sensor position was determined. The reconstruction model was based on the geometrical relation between the two-dimensional (2D) information in the FLIR thermal images and the true size and location of objects existing in the real world. The time was set within the model based on the time information in the images and the reliable frame rate of the video standard. In all probability, the FLIR operator set the time and date information when he initialized the FLIR system.

One of the problems encountered when reconstructing 3D information from FLIR videotape Q-4 was the lack of detailed platform data. Fortunately, the Nightstalker's FLIR sensor is well described in research literature. Additional information requested and provided by the Office of Special Counsel, were reliable measurements of the complex and weather conditions for April 19, 1993.

As the solar specular reflection hypothesis did not fully explain the appearance of some of the flashes, the characteristics of the FLIR sensor and the video format were also studied. The Fort Hood flight trials were also analyzed, section 5.5. This analysis was motivated from the results in section 5.1, where it was concluded that the FLIR system could distort the image representation of small objects such as the flashes.

The image analysis confirmed that the analyzed flashes were specular solar reflections or other kinds of heat reflections from single or multiple objects. Moreover, the FLIR and video recording system induced image distortions, which affected several of the flashes seen on the FLIR images. The results from this investigation were confirmed by conducting an experiment, section 5.5. Due to the many contradictory conclusions by experts concerning the cause of the flashes, reports, statements and videotapes by Branch Davidian and government experts were carefully reviewed and summarized in chapter 7. This review supported the result from this investigation.

The flashes that have been analyzed are detailed in table 2. The table is based on the list provided by Vector Data Systems (U.K.) Ltd., updated with some additional observations from this investigation. The color-coding as illustrated in figure 1.1 has been used to roughly indicate the position of the flashes.

START	END	VDS	NOTES	SIDE
		#		
10:53:24	10:53:25	1	Reflections from water surface towards gym	Black
10:54:20		2	Flash at damaged structure	Red
11:05:50	11:05:53	3	Flashes near a water storage tank	Green
11:14:10		4	Flashes at damaged structure	Red
11:18:21	11:18:23	5	Flash from left rear hull of Combat Engineering Vehicle 2 (CEV 2)	Black
11:18:48		6	Flash at demolished corner of gym	Black
11:23:25		7	Flash near left rear of CEV 2, close to gym	Black
11:24:30	11:24:35	8	Flashes directly to the rear of CEV 2	Black
11:24:50	11:24:51	9	Flashes on cafeteria roof	Black
11:25:02		10	Flash on chapel roof	Red
11:25:04		11	Flash on chapel roof	Red
11:26:27		12	Flashes near rear right drive sprocket of CEV 2	Black
11:28:04	12:28:14	13	Flashes in courtyard in front of central tower	Green
11:28:18	11:28:21	14	Flashes on cafeteria roof	Black
11:28:22		15	Flashes on cafeteria roof	Black
11:30:08	11:30:14	16	Flashes (weak) in courtyard in front of central tower	Green
11:30:26		17	Flashes on cafeteria roof	Black
11:34:32		18	Flash in courtyard in front of central tower	Green
11:34:32		19	Object moving from destroyed corner of gym to diving	Black
11 04 00		20	platform	D1 1
11:34:33		20	Flashes on cafeteria roof	Black
11:34:45		21	Flash on chapel roof	Red
11:38:31		22	Flash in front of CEV 2	Black
11:38:45		23	Flash at "black spot" at innermost penetration by CEV 2	Black

			into gym	
11:42:00	11:42:01	24	Flashes at damaged structure	Red
11:42:32	11:42:33		Flash in demolished gym area	Black
11:43:33		25	Flash on single-storey roof	White
11:43:35	11:43:38	26	Flashes on single-storey roof	White
11:44:48		27	Flash on cafeteria roof	Black
11:44:52	11:44:54	28	Flashes on cafeteria roof and courtyard near central tower	Black
11:45:15	11:45:24	29	Flashes on single-storey roof (flag pole end)	White
11:46:32	11:46:33	30	Flashes on ground at base of central tower and close to or	Black
			on cafeteria roof	
11:46:34		31	Flash in courtyard	Green
11:46:36		32	Flash on cafeteria roof	Black
11:46:43		33	Flash near central tower	Black
11:47:05		34	Flash on single-storey roof	White
11:48:14		35	Flash on cafeteria roof	Black
11:49:01	11:49:08	36	Flashes on single-storey roof	White
11:50:17		37	Flash in courtyard near base of central tower	Green
11:50:27		38	Flash in courtyard near central tower	Black
11:50:59	11:51:04	39	Flashes on single-storey roof	White
11:55:46	11:55:47	40	Flashes on single-storey roof	White
11:57:25	11:57:28	41	Flashes on single-storey roof	White
11:58:04		42	"Flash" as CEV 1 withdraws from main door	White
11:59:03		43	Flashes on single-storey roof and also on roof near	White
			damaged area	
12:00:40		44	Flash behind CEV2	Black
12:01:06		45	Flashes on ground in debris side of chapel	Red
12:05:13	12:05:17	46	Flashes on single-storey roof	White
12:08:31		50	Flashes near catwalk roof in gym	Black
12:08:48	12:08:50	51	Flashes near corner of damaged gym, closest to central	Green
			tower	
12:08:51	12:08:52	52	Flashes next to CEV 2 at gym	Black
12:09:00		53	Flash on lean-to roof side of chapel	Black
12:09:23		54	Flash from inner courtyard, right of tower	Green
12:09:59		-	Flashes on CEV	Green
12:10:42		56	Person lying on single storey roof	Black
12:10:48	12:10:53	-	Multiple flashes in debris in courtyard	Green
12:10:58	12:11:23	57	Multiple flashes in debris in courtyard and on chapel roof	Green

Table 2. List of analyzed flashes.

All events in table 2 and in particular events 5, 50 and 53, have been thoroughly enhanced as described in section 5.2. Events 19, 50-52 and 56, as well as several additional sequences of low contrast, have been investigated in section 5.3. The flight path and the flashes were analyzed as described in section 5.4 and 5.5 respectively.

A second, primary image analysis task was to apply methods for tracking, pseudo-coloring and measuring the imagery at the initial phase of the fire. Events 47-49 and 55 have been excluded from table 2 as events related to the fire were analyzed separately as described in section 5.6.

The first time some of the events are visually detectable on the FLIR videotapes depends on the imaging techniques and display units, among other factors. This was considered in this investigation. All times for the first visual appearance of events stated in this report were based on the image quality, system configuration, display units and monitors as described in chapter 4.

The term "image" will be used for the reminder of this report to denote one field in a video frame. Fields have been used throughout this investigation for image processing and analysis. The reason for this was to avoid the motion blur induced by the video format that frequently disturbs the image quality. The video format is further explained in chapter 6. "Image" will also be used to denote a digitized photo, photo or duplicate image. "FLIR sensor" will be used as an acronym to the term "camera."

5.1 Characteristics of the FBI Nightstalker FLIR Imaging System

The FLIR sensor in the FBI Nightstalker is different from an ordinary video camera equipped with a CCD sensor. The FBI Nightstalker FLIR is a serial/parallel scanner system, aimed for long-range and is based on a SPRITE/TED detector. The ability of this FLIR system to resolve small objects depends mainly on its spatial resolution and thermal sensitivity. Video format, monitoring devices and operator abilities can also affect resolution capabilities. For the SPRITE/TED some additional parameters were of great importance. For this reason, the characteristics of the FBI Nightstalker FLIR system and its SPRITE/TED detector, see figure 5.2, and scanning mechanisms were carefully reviewed.

Many of the commercially available computer programs for photogrammetry, three-dimensional (3D) reconstruction and video processing are based upon the use of "ordinary" short-range staring cameras. The known characteristics of the FLIR system and its impacts on the image quality were incorporated as part of the image analysis procedures described in the remaining of this chapter. It was also used for estimating errors in the algorithms on which the analytical methods were based.

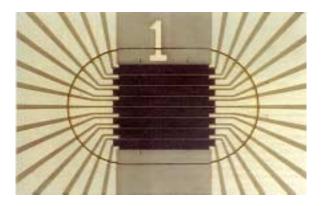


Figure 5.2. A SPRITE/TED array, from [Baker] p. 153.

5.1.1 The FBI Nightstalker FLIR Sensing System

The word "FLIR" was originally used to denote airborne Forward-Looking InfraRed thermal imaging systems, but has since been adopted to denote thermal imaging system in general. Many early FLIR systems were mounted fixed relative to the aircraft and directed towards the target by directing the fuselage. The FBI Nightstalker FLIR is not only forward looking, an operator can also direct the FLIR sensor ±120° in the horizontal plane (azimuth angle, AZ) and -20° to -80° vertically (elevation, EL) relative to the carrier aircraft. According to information received from the Office of Special Counsel, the carrier was a multi-engine turboprop aircraft. An on-board operator maneuvered the FBI Nightstalker FLIR during the surveillance whilst the FLIR videotapes were recorded. This directional control of the sensor relative to the aircraft is seen on the FLIR images, both numerically and graphically, figure 5.3. The date and time information in this report refers to the numerical presentations seen in the FLIR images, figure 5.3.

Using a wide field of view provides a useful overview typically used for target detection. A narrow field of view is generally used for tracking and recognition of distant or small targets. The operator of the FBI Nightstalker FLIR could select either a wide field of view (WFOV) 9.7° x 6.5° or a narrow field of view (NFOV) 1.6° x 1.08°. WFOV was in use when capturing figure 5.3. NFOV was in use when the flashes in table 1 appeared on April 19, 1993. The concept of dual fields of view are in many cases inspired from the biological visual system of particularly sharp eyed birds, like hawks, as their center of the field of view provides a far better spatial resolution than peripheral views.

Normally, the term mid IR is used to denote wavelengths in the spectral range 3-5 μ m, while far IR is used to denote 7-13 μ m. The SPRITE/TED detector in the FBI Nightstalker FLIR system operated in the far IR band, 8-13 μ m.



Figure 5.3. FLIR image graphics.

Thermal images are directly related to the thermal radiation variations from the scene, as illustrated in figure 5.4. To obtain optimal image quality the thermal window and the offset temperature can be adjusted to meet the dynamic requirements of a scene. "Gain" is often used to denote the instantaneously thermal range, or thermal window of the depicted scenery. In this case, "bias" defines the offset temperature in relation to the specified operating range of the system.

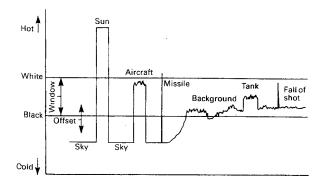


Figure 5.4. Dynamic range requirements of a typical scene illustrating the thermal window and offset bias, from [Cuthbertson] p. 25.

Two different dynamic range settings are illustrated in figure 5.5. The output signal from the FLIR sensor on April 19, 1993, varied sometimes very rapidly. This rapid variation in image intensity was related to the dynamic "gain" and "bias" that were automatically adjusted to the dynamic range of the

scene for almost the entire time FLIR videotape Q-4 was recorded. During the image processing for the fire investigation, the image intensity variation was measured for uniform temperatures at the Branch Davidian complex, section 5.6 figure 5.36. These variations were assumed to be related to the FBI Nightstalker's circular two-minute turns and the bearing to the sun. From this, it was concluded that it is very unrealistic to believe that an operator on board the FBI Nightstalker could have induced these rapid and regular variations in dynamic range.



Figure 5.5. Examples of two different thermal windows for the same scenery as indicated by the dynamic range scale (red circles).

There is nothing that corresponds to color in thermal images. As a result, FLIR images often are represented by a grey scale and recorded as a luminance signal on the videotape. The FBI Nightstalker FLIR operator could chose between using white to represent high temperatures in the thermal window and black for low, or the inverse, see figure 5.3. White was chosen by the FBI Nightstalker FLIR operator to represent hot for almost the entire recorded portion on FLIR videotape Q-4. Black represents hot in the two FLIR images in figure 5.8.

5.1.2 The SPRITE/TED Detector

The word "SPRITE" is an abbreviation for <u>Signal Processing In The Element.</u> C. T. ELLIOTT, [Elliott], originally developed the Thomas Elliott Device (TED) concept at Mullard, U.K.. The SPRITE/TED detector is also described in [Cuthbertson], [Baker] and [Philips].

The SPRITE/TED detector element is essentially a strip of infrared-sensitive material on a sapphire substrate. The detector elements are wide in the horizontal direction, see figure 5.2 and 5.6. The detector elements are of type Cadmium Mercury Telluride (CMT) and the integration time is fixed. There are only three electrical connections for each detector element. When a small region of the infrared sensitive strip

is exposed to infrared radiation, excess current carriers are generated in that region, see figure 5.6. The excess current drift towards the readout region, at a velocity determined by the magnitude of the bias current. The drift velocity is in fact quite high and matched to the velocity at which the infrared image is scanned along the strip. Under the TED concept, each of the eight elements were constructed for built in time delayed integration (TDI). With this construction the number of detector elements was reduced and there was no need for external TDI circuitry. The SPRITE/TED introduced a new technology in thermal imaging to overcome these problems. SPRITE/TED detectors became very popular and are used in a variety of applications.

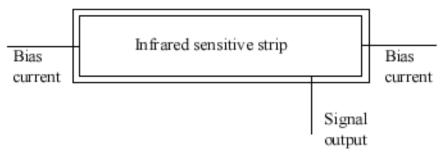


Figure 5.6. The SPRITE/TED detector element.

This particular kind of signal processing improves the signal-to-noise ratio, which in turn increases the ability to detect small or distant targets. It may, however, reduce the ability to resolve fine structural details.

Due to delay effects in the detector element itself, an exposure of thermal energy that is short in duration can appear in a longer time interval than the exposure itself. This phenomenon is known as time delay, not to be mixed up with TDI, and is expressed as a time constant, τ . This time constant τ of a detector is the time for the output signal to fall to 37% of its value after a radiation pulse has ceased, further described in [Philips]. The time constant τ can be estimated by applying a pulse of radiation to the detector and measuring the interval between the time of cut off and the time when the detector radiation output falls to 37% of its peak value. The true time delay for the FBI Nightstalker FLIR could not be measured, as the original FLIR was unavailable. However, the sensor element in the FLIR system is made of CMT and the time constant for such an element is less than 5 μ s [Philips]. As eight detector elements are scanned in parallel, this reduces the scanning speed. The exact scanning speed of the FBI Nightstalker FLIR system is unknown, but, in general, this time delay could correspond to 1.6% of the scanning time for a video line in the FLIR-sensor.

Misalignment in bias current and the horizontal scanning speed are another phenomena that can also cause image details to be elongated in the direction of the scans.

It was concluded that thermal energy of short duration could appear longer in duration than in real

life. These phenomena will result in an elongation of small objects in the direction of the scans, which for the FBI Nightstalker FLIR was in the image's horizontal direction. In fact, several of the flashes in table 2 were elongated in their shape. Examples of flashes with an elongated shape are the events from 12:10:48 and onwards where the same part of the Branch Davidian complex was viewed from different positions. The horizontally elongated shape of these flashes remained the same, regardless of the FBI Nightstalker FLIR movements, illustrated in figure 5.7.

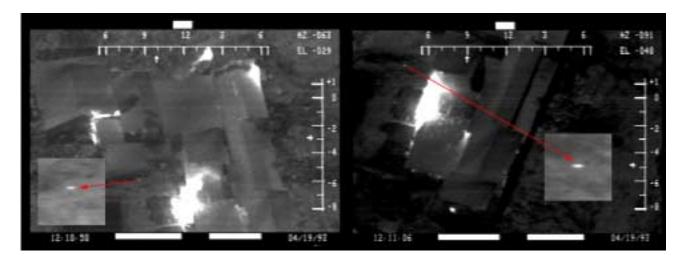


Figure 5.7. Horizontally elongated flashes from the same ground position, seen from two different aircraft positions at 12:10:50 and 12:11:06. The highlighted regions at the red arrows are unprocessed enlargements from the left and right image respectively.

In short, the effects from the FBI Nightstalker FLIR system, in particular the signal processing, time delay and the misalignment in bias current within the SPRITE/TED could be seen to contribute to the horizontal smearing of small objects of high thermal energy.

5.1.3 The Scanning Mechanisms

The FBI Nightstalker FLIR detector was mounted in a moveable turret on the carrier aircraft. The on-board operator directed this turret towards the Branch Davidian complex. The thermal radiation of the scenery passed through the optics and was projected onto the SPRITE/TED detector element by a combination of horizontally and vertically scanning mirrors. It takes several steps to project the thermal radiation onto the detector element. Each image was built up by serial/parallel scans to generate a full picture. Several serial scans in the horizontal direction are required to build up the full image where each scan generates eight video lines. Scanning mechanisms are known to degrade image quality more than conventional staring systems.

Amplification and further gain adjustments are applied within the FBI Nightstalker FLIR system to

remove any non-linear performance of the eight detector elements. Under sub-optimal operating conditions non-uniformity between detector elements has caused a striped noise pattern to be generated on the April 19, 1993, FLIR videotapes, see figure 5.8.

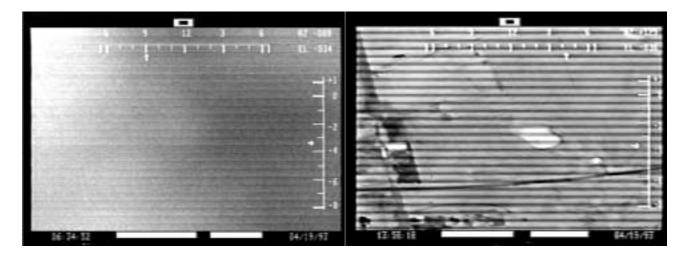


Figure 5.8. Artifacts from non-uniform outputs from the eight detector elements (left) and detector cooling problem (right) causing non-uniform outputs from serial scans.

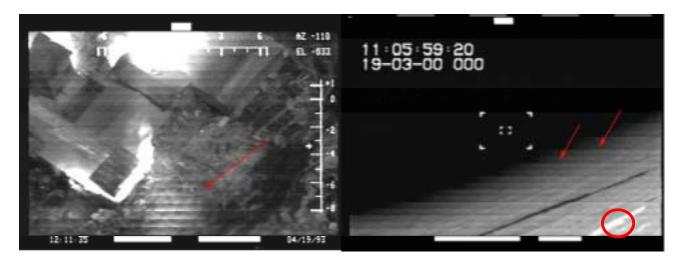


Figure 5.9. Artifacts caused by scanning mechanism in combination with flare from the optics (red arrow left image). Jagged edges (red arrows right image) from the scanning mechanism and detected horizontal displacements (red circle right image). The left image is from FLIR videotape Q-4. The Lynx FLIR recorded the right image during the FLIR Fort Hood trials, which are similar to the FLIR used to record FLIR videotapes Q-1 – Q-7.

Detector elements need cooling and can be quite sensitive to changes in operating temperature.

The effect of deviations from the optimal operating temperature could occasionally be seen in the FLIR images as non-uniform performance between raster scans, see figure 5.8. Another typical noise pattern appears when flare occurs within the system optics, figure 5.9. Spatial displacement in the image horizontal direction was detected, as an effect of the vertical jagged edges caused by the raster scans, illustrated in figure 5.9.

5.1.4 Effects of the FBI Nightstalker FLIR system on FLIR imagery

Imaging systems are not perfect. The functionality and the scanning mechanisms of the FBI Nightstalker FLIR created several kinds of distortions and noise patterns. In addition, mechanics of the video machine and the interlaced video format used to record the thermal images can also be a source of distortion and noise patterns. These distortions can seriously affect the representation of objects in the FLIR imagery that are about on the limit of the FLIR system's resolution capability.

The elongated shape of several of the questioned and small flashes, aligned to the image horizontal direction, was concluded to be a product of the FBI Nightstalker FLIR system. Therefore, it can not be trusted that the FLIR images represent the flashes' true shape, size and content.

5.2 Image Enhancement

Image enhancement of the flashes was performed to expose information present in the image sequences, but not directly obvious to the human eye. The aim was not only to analyze the flashes, as this would be a rather unrewarding process due to their nature. It was more important to analyze the region near the flashes.

To reduce some of the complex non-linear noise and blur pattern induced by the FLIR system, several combinations of noise and blur reduction techniques were tested. Sequences digitized several times from the same recorded portion of FLIR videotape Q-4 were arithmetically merged to further reduce the noise. It was found that the best way to deal with the complex noise pattern was to filter image sequences with an image restoration technique based on the total variation of all noise components, [Rudin]. This method successfully deals with more complex noise models and was most suitable for the noise characteristics apparent in the April 19, 1993, FLIR videotapes.

Super resolution was further used to enlarge the image sequences to produce images with higher resolution. Super resolution is one of the most promising and relatively new techniques for enlarging images digitized from video, [Guichard]. Matching image information from consecutive frames into a super-frame creates a higher-resolution image. In this way, the resolution can be increased, rather than just appear as larger pixels within an image. The super-resolution algorithm required prior estimation of the image motion to compensate for temporal variations in an image sequence.

"Motion" is an essential parameter for many image enhancement techniques. Basically there are two different kinds of motion: physical motion in the real world; and the apparent two-dimensional image motion induced by movements of the FLIR sensor, the FBI Nightstalker aircraft, and any local and global movements in the scenery.

There are several ways to model motion. For example, if a car is driving straight from the left to the right in an image. This is translating image motion. It is quite simple to estimate and reconstruct physical translating motion in the real world from image motion. If the car instead drives towards the camera, its scale will vary. Its scale will also vary if the camera moves relative to the car. If the car makes a turn, there will be a rotational motion. In this case, the motion of the Branch Davidian complex in the FLIR imagery was somewhat more complex, as both translating and rotating motion are apparent and with the scale varying nearly all the time. Therefore, a piecewise linear motion model ("affine model") was used to model the more complex motion. The affine motion model was used to match the image information in consecutive fields prior to super-resolution.

All events in table 2 were reviewed using the original FLIR videotapes. For the events on FLIR videotape Q-4 between 10:41:57 – 12:16:13, in table 2, the following procedures were utilized:

- A) The sequences were digitized in an uncompressed format to an image width of 720 x height 486 x 24 bits. In this sequence the dynamic range of the grey levels were only slightly affected.
- B) The sequences were digitized in an uncompressed format to an image width of 720 x height 486 x 24 bits. The dynamic range of FLIR videotape Q-4 was digitized without bit reduction.
- C) The sequences were digitized in an uncompressed format to an image width of 720 x height 486 x 24 bits with stretched dynamics (before digitizing the video signal) to enhance the contrast.
- D) Noise reduced sequence: noise was reduced in 10 iterations using a movie deblur noise reduction technique. These sequences play back at half the normal speed as each processed field was repeated twice to form one new frame.
- E) Noise reduced sequence: noise was reduced in 10 iterations using a total noise variation technique. These sequences play back at half the normal speed as each processed field was repeated twice to form one new frame.
- F) Super-resolution sequences were created using four consecutive image fields to increase the final resolution. These sequences play back at half the normal speed as each processed field was repeated twice to form one new frame.
- G) Split-screen sequences were generated for comparison and review, see figure 5.10. These

sequences play back at half the normal speed as each processed field was repeated twice to form one new frame. The upper left quadrant of the screen contains a cropped version of the above sequence A. The upper right quadrant depicts the corresponding sequence with increased resolution, sequence F super-resolution using frame fusing techniques. The bottom left and right quadrant of the screen depicted from left to right shows:

- sequence C, with stretched dynamics to enhance the contrast
- sequence D, with motion deblur noise reduction technique applied
- sequence E with total variation noise reduction technique applied

Sequences D) -- G) utilized the sequences A) -- C) as input. The split sequences were created for comparison of processed sequences to the same unprocessed sequences. By analyzing the split sequences it was verified that no significant artifacts were induced.



Figure 5.10. A view from the split-screen sequence from event 53 at 12:09:00.

The results from reviewing sequences A) – C) was that several moving objects were detected, however nothing was detected in close proximity to any of the listed flashes. Several events were also analyzed in depth utilizing the procedures D) – G). For example, event 5 during 11:18:20 – 24, event 50

during 12:08:30 - 34, and event 53 during 12:08:59 - 12:09:03. Nothing in close proximity to any of these three flashes was detected within any of these sequences.

When analyzing event 50, moving objects were detected and the sequence 12:08:34 - 12:08:39 were enhanced by the same techniques A) – G) and further investigated in section 5.3.

5.3 Motion Detection, Tracking and Analysis

An individual's radiated temperature difference relative to the background will vary as he moves. This can cause a person to appear alternately as colder or warmer than the background due to the wider temperature interval of the complex background. For this reason moving persons, in most cases, are easier to detect than persons standing still are. Occasionally a person's radiated temperature difference can be the same as the background. Consequently, a person can appear "thermally invisible." This same person, however, will most probably be traceable before and after entering the area where his temperature is about the same as the background. This is illustrated by an example from the Fort Hood Lynx copy videotape (app. 2 item 17), see figure 5.11. FLIR videotape Q-5 also contains several examples of this phenomenon where persons attending the fire momentarily "disappeared" when walking across the water-cooled roof of the tornado shelter.

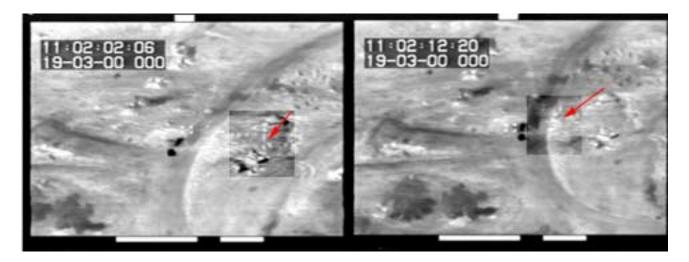


Figure 5.11. Examples of persons from the Fort Hood flight trials, Lynx helicopter. The persons moved from the initial position in the left image (red arrow in the highlighted part) to the position in the right image (red arrow in the highlighted part) where they are more difficult to detect.

Several videotapes and images were reviewed prior to the analysis of the April 19, 1993, FLIR videotape Q-4 in order to identify temperature intervals and spatial dimensions that correspond with a human's form and movement. The Office of Special Counsel prepared a ground FLIR recording of the flight trial which recorded absolute temperature measurements of ground activity during the trial, (app.2

item 36). The Fort Hood flight trial FLIR videotapes (app. 2, items 16-18) and FLIR temperature measurements provided a known source of data as persons were clearly seen on these videotapes. In addition, the duplicate photos and copy videotapes were reviewed. On FLIR videotape Q-1 and Q-3 persons were, for example, seen on a road crossing at 06:56:20. From reviewing the complementary source data, it was also verified that a person was seen on the single story-roof from 12:08:42, event 56 on FLIR videotape Q-4. After this time several persons attending the fire were clearly seen on the FLIR videotapes Q-4 and Q-5.

In the case of alleged gunfire on FLIR videotape Q-4, a reasonable assumption is that persons by necessity, need to appear close to the muzzle blast flashes. The Fort Hood flight trial results confirmed this assumption and clearly show individuals proximate to their weapon and the muzzle blast created by the weapon when the individual fired it. The trial videotapes also showed that different clothing types vary in contrast, figure 5.12. This phenomenon was less visible on the FLIR videotape created in the Lynx helicopter compared with the FLIR videotape created in the Nightstalker FLIR at the Fort Hood trials. The Lynx FLIR was of a less sophisticated design, but more similar to the FBI Nightstalker FLIR system used to record videotapes Q-1 – Q-5 on April 19, 1993.

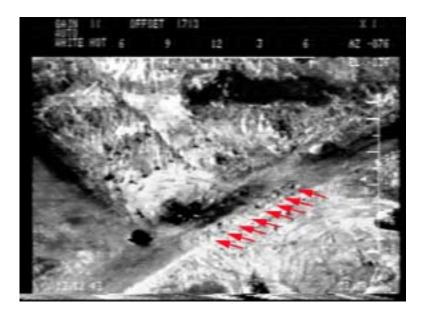


Figure 5.12. Contrast variations for suits worn at the Fort Hood flight trials.

In short, it is possible to detect persons on the FBI Nightstalker FLIR videotapes, regardless of the kind of suite worn, whenever the contrast relative to the background temperature and the imaging system configuration allows detection. The thermal sensitivity of the FLIR sensor, the radiated temperature of a person, the background temperature ranges, the spatial resolution of the FLIR system and the persons form are all contributing factors to the possibility of detecting persons. It is implausible to assume that a

moving person would have the same temperature as the adjacent background at all times on the FLIR videotapes.

The image motion between two consecutive video fields consists of two different kinds of motion from the real world; camera motion and physical motion. Since both background and objects move due to the moving FLIR sensor, detection and tracking of moving objects is difficult. However, moving objects and the Branch Davidian complex formed different motion and the tracking technique was designed only to track objects that moved relative to the Branch Davidian complex in the FLIR images.

Sophisticated tracking techniques were used to track moving objects, to separate moving objects relative to the motion of the Branch Davidian complex in the FLIR images, measure object sizes, analyze contrast variations and review the complementary imagery. Methods aimed to further analyze the characteristics of any detected humanlike motion pattern were not applied as no such motion was detected.

An initial review of the FLIR imagery was conducted. Special care was given to the sequences where the dynamic range had been expanded to enhance low contrast areas. Any movement in these areas would be less visually detectable, if it existed.

Based on the result of this initial review, several additional sequences were selected for analysis. The FBI Nightstalker FLIR system provided the on-board operator the ability to manually activate an event mark. The event mark can be seen as a white, square shaped graphics in the center of the image, similar to the event mark in figure 5.9. Because an event mark would suggest the operator had spotted some activity or event of interest on the FLIR imagery, those sequences from FLIR videotape Q-4 were also carefully reviewed. Table 3 includes a list of the sequences reviewed between 10:41:58 and 12:09:00. The entire picture area was reviewed unless otherwise stated in table 3.

TIME	VDS#	COMMENTS
10:41:58		Event mark, FLIR images in black hot mode
10:46:09		Event mark, searched the road crossing
10:53:00		Event mark, searched the low contrast area in courtyard towards chapel and
		surroundings
11:00:15		Event mark
11:04:50		Event mark, searched black side near damaged structure
11:08:53		Searched area left from CEV and debris area
11:09:34		Event mark, searched the nearby terrain
11:12:58		Event mark
11:15:02		Event mark
11:26:09		Event mark, searched the area where the CEV penetrates the building
11:27:00		Searched the area from corner of swimming-pool towards courtyard
11:27:44		Event mark, searched the area between pool and gym

11:30:15		Searched the area between swimming-pool and gym
11:34:32	19	Searched the debris area for low contrast objects
11:35:49		Event mark
11:39:40		Event mark
11:43:34		Searched the debris area for low contrast objects
11:50:07		Searched the area between the chapel and the central tower
11:50:54		Event mark
12:06:26		Searched the area between damaged structure and swimming-pool
12:06:42		Searched the area between damaged structure and swimming-pool
12:07:02		Searched the area between damaged structure and swimming-pool
12:08:31	50-52	Searched the area left of CEV and the debris area
12:09:00		Searched area left of CEV

Table 3. List of analyzed events.

Some of the events of low contrast to the background were analyzed in depth as a result from analyzing the sequences in table 3.

- Event 19 at 11:34:32 was concluded to be a square shaped debris blowing towards the diving platform. The diagonal size of the object was about 2' 4" ± 2". Human motion was not detected prior to, during or after this event.
- Moving objects seen at 12:06:26 55 appeared square in shape and does not have the spatial dimensions or temperature intervals associated with a human. It was concluded to be debris blowing in the wind, one example is seen in figure 5.13.
- At 12:08:31 12:08:56 several objects were moving among the debris in the demolished gym area. The objects were of both high and low contrast, relative to the background. Duplicate ground view photos were examined from which some of the moving objects could be identified. The estimated size of one object was about 2' 4" ± 4". This could be considered to be an approximate size for a person seen from the FLIR sensor field of view. However, it was concluded to be debris as some rapid variations of the object's intensity were detected. These rapid variations make it implausible to be a person, but realistic to be a piece of debris. By reviewing the enhanced sequences described in section 5.2, tracking of objects, measuring object sizes and contrast variations and reviewing complementary imagery, it was concluded all of these detected objects were debris moving in the wind.

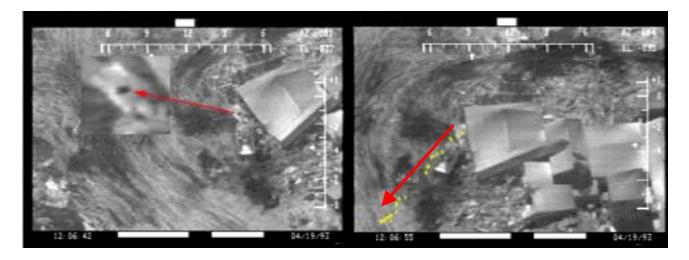


Figure 5.13. A square shaped debris (left, red arrow) seen blowing in the wind from 12:06:43 – 55 and its movements relative to the Branch Davidian complex (right, yellow dots, direction indicated by red arrow).

At 12:09:00 – 01 an object moved close to the CEV. The size of the object was estimated to be about 3' – 5'. For the same reason as the object seen at 12:08:31 – 12:08:56, it was concluded to be debris from the demolished building.

The result from analyzing these events are based visual reviews of the FLIR videotapes, reviewing enhanced sequences, tracing the objects movements, measuring object sizes, analyzing contrast variations and reviewing the complementary imagery. It was concluded that all of the detected objects were debris from the demolished complex set in motion by a CEV and/or blowing in the wind. No activity that can be determined to be moving persons was detected on the sequences from FLIR videotape Q-4 in table 3 between 10:41:58 to 12:09:00, except the person seen lying on the single storey roof from 12:08:42. Neither were any activities that can be determined to be moving persons detected on complementary photos nor videotapes, bearing in mind their limited image quality.

5.4 Tracking of the FLIR Sensor Position

In the case of solar specular reflections, the variation in FBI Nightstalker's flight path gives a logical reason for the flashes intermittent appearance. The appearance of the flashes is closely related to variations in the FBI Nightstalker's flight path. Moreover, the duration-time of the flashes is closely related to the speed of the FBI Nightstalker. To further investigate these assumptions a three-dimensional (3D) model was needed. Constructing a 3D model of the FBI Nightstalker's flight path required a detailed review of both the pilot induced maneuvers and weather conditions existent on April 19, 1993. The parameters investigated were:

- aircraft positions relative the complex;
- aircraft ground speed; and
- wind strength, heading and variations at altitude.

In this 3D model, reconstructed flash data, the orientation of the Branch Davidian complex, the bearing to the sun and the instant positions of the FBI Nightstalker were incorporated to reconstruct the flash geometry, section 5.5. This computer model is illustrated in figure 5.14 and also in figure 1.1.

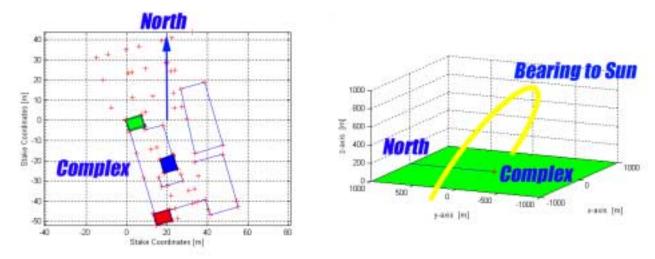


Figure 5.14. A 3D model of the complex (left) based on GPS stake coordinates seen from above. The model oriented towards north and incorporating the bearing to the sun from sunrise to sunset (right). All dimensions are in meter, [m].

Stake positions provided ground level stake coordinates of the complex, (app. 2, item 50). The FBI prepared the stake positions during their processing of evidence from the Branch Davidian crime scene. The bearing to North was obtained from aligning the stake positions for the complex to the bearing to the sun in a FLIR image at 11:39:02. In this image the azimuth bearing to the sun was aligned to the FLIR sensor position. The position of the sun on April 19, 1993, was obtained online from Astronomical Applications Dept. U.S. Naval Observatory [AA].

The size of the central tower roof was used for the 3D reconstruction of the flight path and the 3D reconstruction of flash geometry as seen from all directions. The size of central tower roof was estimated from the stake coordinates. The estimated values were confirmed from a CAD-model (app. 2, item 51) and additional measurements in the FLIR and complementary images. The heights of the three towers were estimated from the CAD-model and also from additional measurements in the FLIR images and complementary images.

To verify how the Nightstalker's flight path varied over time, the weather conditions for April 19, 1993, were also needed. Climatic data from U. S. Department of Commerce (app. 2, item 72) provided such information. Automated weather observations conducted by McGregor Municipal airport were also recorded onto the audio of FLIR videotape Q-1. The automated weather observation was confirmed by comparison to the audio transcripts (app. 2, item 70).

Comparing the ZULU time mentioned on the automated weather observations to the time on FLIR videotape Q-1 verified that the time on FLIR videotape Q-1 was given in Central Daylight Time (CDT). The error for the time information on FLIR videotape Q-1 was estimated to CDT \pm 30 seconds. The time given on the remaining FLIR videotapes were assumed to be as reliable.



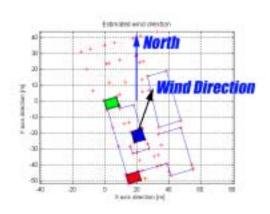


Figure 5.15. The average wind direction at ground level estimated from the cooling effect on the central tower roof (red and black arrow).

On April 19, 1993, the wind at ground level was quite strong. The instant wind direction can be assumed from the flag on the white side of the complex. According to the automated weather report recorded at 6:02 a.m., the wind direction is 180° degrees from true north, wind speed 24 knots and peak wind speed up to 28 knots. This was verified by the weather data. The average wind direction can also be seen on FLIR videotape Q-4, as the wind cools off the roof from the direction where the wind comes from, see figure 5.15. The average wind direction at the complex, at ground level during the time the flashes appeared was measured to $200^{\circ} \pm 20^{\circ}$, which agreed with the weather data for the same time.

Normally, the wind at altitude increases and changes in direction. This affected both the airspeed and flight heading of the FBI Nightstalker. Climatic data regarding the wind at altitude could not be found. However, at the FBI Nightstalker's operating altitude, the wind was estimated to come about 20° -30° more from the southwest than the ground level wind, $220 \pm 25^{\circ}$. A 40° -50° variation in wind direction at the FBI Nightstalker's operating altitude was fully possible on April 19, 1993. This was

verified by visually reviewing the variations in image motion, variations in AZ- and EL-angle for the FLIR sensor relative to the aircraft movements and by observing the smoke from the fire on FLIR videotapes Q- 4 and Q-5. Wind strengths up to 35 - 45 knots at the aircraft's operating altitude were fully possible on April 19, 1993.

The speed of an aircraft is a more complex parameter as there are several ways to define airspeed. The speed of the aircraft as shown by the aircraft's avionics is not necessarily the same as the aircraft's ground speed (GS). True airspeed (TAS) is the airspeed of an aircraft relative to undisturbed air and corrected for the aircraft's altitude, the temperature and other factors. Ground speed (GS) is explained as the aircraft's speed relative to the ground. TAS will, however, be equal to GS if there is no wind.

It was assumed that the FBI Nightstalker operated at an airspeed of about 160 knots, from studying the aircraft handbook (app. 2, item 69) and the image motion on FLIR videotape Q-4. Flying with a 40 knots head wind will result in 160 - 40 = 120 knots GS. Flying with a 40 knots tail wind will instead increase the ground speed to 160 + 40 = 200 knots GS. As a result, 160 knots gives a speed relative to the ground that will vary between 120 - 200 knots GS. Consequently, head wind has decreased the FBI Nightstalker ground speed and tail wind has increased the FBI Nightstalker ground speed.

By reconstructing the FLIR sensor position for three two-minute sequences (1) 10:55:23 - 10:57:57; (2) 11:34:20 - 11:36:18; and (3) 11:58:30 - 12:00:46, it was seen that the aircraft ground speed varied for the turns, see figure 5.16 and 5.17. This provided verification that the FBI Nightstalker circular movements had varied both in altitude and distance relative to the complex. The FBI Nightstalker ground speed was calculated from the reconstructed data. The calculated ground speed of the FBI Nightstalker during the reconstructed turns varied between 120 - 200 knots GS. The measurement error was estimated to ± 20 knots for the calculated GS.

The strong wind probably caused the FBI Nightstalker to drift off from an ideal path and thereby caused the variation in aircraft's position relative to the Branch Davidian complex seen in figures 5.15 and 5.16. The variations in aircraft altitude, seen on the reconstructed data in figure 5.17, are realistic altitude variations in such weather conditions.

On several occasions the FBI Nightstalker appeared to be directly above the complex. Reconstructing the position of the aircraft at 11:46:20 verified this, see figure 5.18.

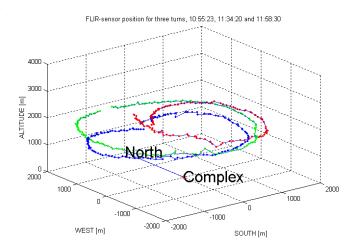


Figure 5.16. FBI Nightstalker circular movements relative to the complex at 10:55:23—10:57:57 (green), 11:34:20 – 11:36:18 (red) and 11:58:30 – 12:00:46 (blue), seen in 3D.

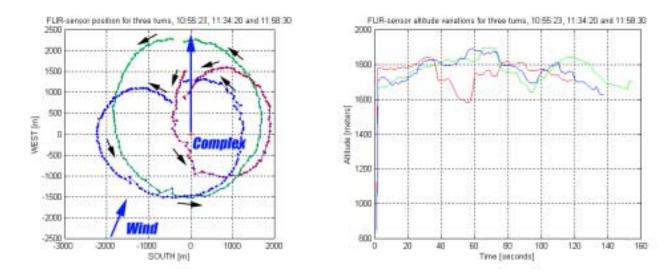
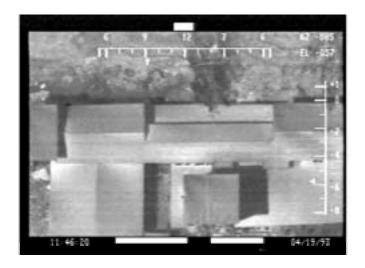


Figure 5.17. FBI Nightstalker's circular movements relative to the complex at 10:55:23—10:57:57 (green), 11:34:20 – 11:36:18 (red) and 11:58:30 – 12:00:46 (blue), seen from above (left) and the variations in altitude (right). Spatial displacements of 3D coordinates were mainly caused by the FBI Nightstalker's FLIR system. As a result, the altitudes (right) have been filtered, utilizing median filtering, to limit effects of object tracking errors.

From reconstructing the FBI Nightstalker's flight path it was concluded that the position, altitude and ground speed of the aircraft relative to the Branch Davidian complex varied significantly. This supported the hypothesis that the variation in FBI Nightstalker's flight path contributed to the flashes

intermittent appearance, as the aircraft sometimes flew through a solar specular reflection and sometimes flew beside the same reflection. The duration time of such reflections is significantly affected by the FBI Nightstalker's ground speed. Therefore, the FBI Nightstalker's flight path and airspeed can <u>not</u> be regarded as constants.



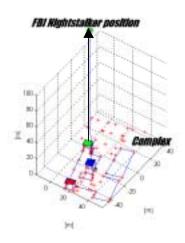


Figure 5.18. At 11:46:20 the FBI Nightstalker, and thereby the FLIR sensor, was right above the Branch Davidian complex at a distance of 1610 meter.

5.5 Three dimensional (3D) Reconstruction of the Flash Geometry

To investigate the potential for solar reflections in depth, the 3D model from section 5.4 was used to reconstruct the flashes' geometry. The theoretical approach for the complete reflection model is described in section 5.5.1. The 3D model was thereafter used to complete the reflection model, which included:

- the position of the sun;
- the position of the flashes on and around the Branch Davidian complex; and
- the FLIR sensor position.

The mathematical model and the results from the reconstructed flash geometry were verified by an additional experiment using a ThermaCAM infrared camera provided by FLIR Systems, Sweden, see section 5.5.8. The results from analyzing the reconstructed flash geometry are summarized in section 5.5.9.

5.5.1 Theoretical Approach

Thermal images are based on temperature difference of naturally emitted light, which depends on the objects' energy exchange with the environment, self-heating, emissivity differences or reflections of other sources. The physical law of reflection is historically attributed to Euclid [Frauen]. In short, the physical law of reflection explains that a ray of light that hits a planar boundary between two media is essentially divided in two parts. One part is reflected and the other part is passed on to the next media at a different angle.

One simple way to model light reflection components can be found in [Vince], see figure 5.19, which is widely used to create lighting effects in virtual images. This model formed the basis on which the geometry of the flashes on FLIR videotape Q-4 were reconstructed, see figure 5.20.

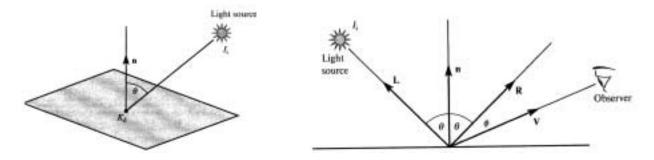


Figure 5.19. A simplistic model of the solar reflection from a planar surface, diffuse reflection component (upper left) and specular reflection component (upper right), from [Vince] p. 82-83.

The behavior of light reflection can simply be expressed as diffuse or specular reflections. Lights reflected by a diffuse surface will be radiated equally in all directions and are independent of the position of an observer. Rough surfaces, like carpets and textiles, exhibit mainly diffuse reflection properties. Specular reflections create a highlight that can be seen only within a limited distance from the reflection ray. Polished surfaces, like glass and metals, can cause specular reflections for which the visibility strongly depends on the position of the observer relative to the specular reflection ray. This reflection model holds for visual as well as infrared wavelength bands.

In the simplistic reflection model of one light reflection, the intensity I, of a pixel at column x, row y and time t summarizes the reflection components of a light source; ambient; diffuse; and specular reflection components.

$$I(x,y,t) = I_{ambient}(x,y,t) + [I_{diffuse}(x,y,t) + I_{specular}(x,y,t)]$$
(1)

$$I(x,y,t) = I_a(x,y,t) K_a + [I_i(x,y,t) * K_d (L • n) + I_i(x,y,t) K_s \cos^g \Phi]$$
(2)

 I_i is the intensity of the light source. K_a and K_d are surface reflection components. K_s is a color-independent specular coefficient. The angle Φ represents the observer V offset from the reflection ray R. L is the direction to the light source, n the surface normal and $L \cdot n$ denotes the scalar product. g is the materials reflection component and the factor $\cos^g \Phi$ and describes how the observation angle affects the intensity of the specular reflection component. The angle θ represents the angle of the reflection, which depends on the substance of the surface among other factors. This reflection model defines the intensity of image pixel values for an illuminated object as a function of the position of the camera and the intensity contributions from ambient, diffuse and specular reflections.

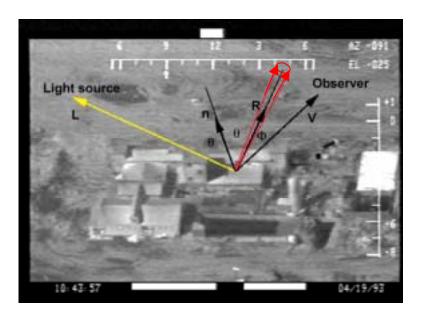


Figure 5.20. The expansion of the specular reflection model into 3D for reconstructing the geometry of the flashes on FLIR videotape Q-4 with the distribution "cone" of the solar specular reflection (red) in where the specular reflection can be observed.

On April 19, 1993, the sun was the light source and any solar specular reflections would have resulted in reflection "cones" in the air above the Branch Davidian complex. As the FBI Nightstalker aircraft approached one of these narrow cones where the flashes would be observable, the angle Φ between the reflection ray \mathbf{R} and the observing FLIR sensor \mathbf{V} , approached zero and the specular component became dominant. This agrees with the way a solar specular reflection is modulated by the $\cos^{g}\Phi$ function. In fact, equations (1) and (2) can in fact be further simplified.

$$I(x,y,t) = c_1 + c_2 \cos^g \Phi \tag{3}$$

In (3) the factor $c_2 \cos^g \Phi$ describes the specular part of the reflection and c_1 and c_2 are constants. Due to the high thermal energy of solar specular reflections, the ambient and diffuse reflection

components make little contribution to the reflection ray. Thus, the specular reflection component can be regarded as a point source with a very limited spatial distribution in the far IR band. Some examples of how *g* affects the size of the area where the specular reflection can be observed as shown in figure 5.21. However, for some of the analyzed flashes, the surface emissivity could not be fully neglected.

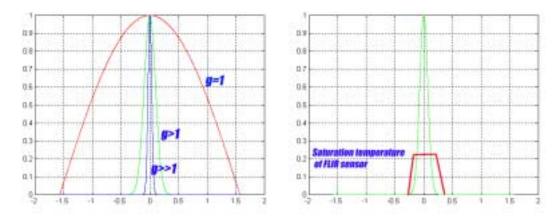


Figure 5.21. Examples of how the factor g affects the reflection geometry (left). The intensity of a reflection where the specular component is dominant (right, green line). An illustration of the intensity observed by a FLIR system (right, red line).

SPRITE/TED detector elements in the FBI Nightstalker FLIR were designed to operate within a temperature range far below the temperature of the sun, figure 5.4. When a solar specular reflections of high thermal energy in the far IR band falls onto the detector elements, the video signal on the FLIR videotapes normally become saturated. This, in turn, caused the corresponding pixels to became white in the FLIR images, as white was selected to represent hot temperatures. Studying [Cuthbertson] and [Philips] verified that the temperature of the sun is far outside the operating temperature range of the FLIR sensor. The intensity that would be observed by the FBI Nightstalker FLIR sensor is illustrated in figure 5.21.

The direction of a reflection ray is determined by the orientation of the reflective surface relative to the light source. Reflecting surfaces are most likely <u>not</u> aligned to the ground plane for the flashes on FLIR videotape Q-4. Moreover, the surface structure, shape and size of the reflecting surfaces were not known, which determines the size of the distribution cone. As a result, the flashes were modeled as sparse points. As the substance of the surface was unknown for the flashes on FLIR videotape Q-4, the reflection angle θ was compared mainly between flashes that appeared from similar positions relative to the complex.

Consequently, if the FLIR sensor captured a solar specular reflection, then the FBI Nightstalker must have entered, passed through and finally left the reflection cone. From a visual inspection of the flashes on FLIR videotape Q-4, listed in table 2, it was seen that the intensity of several flashes increased

and decreased in a way that agreed to the theoretical model of solar specular reflection. In fact, the relation between the duration of a specular solar reflection duration time and the speed and position of the FBI Nightstalker can be expressed as in equation (4).

$$N = 2 m d \sin(\Phi) / s \cos(\theta + \Phi)$$
 (4)

N is the number of frames in which the reflection highlight can be seen. m is the frame rate of the video format, which is 30 frames/second for NTSC. s is the ground speed or the aircraft [m/s]. d is the distance in meters between the complex and the aircraft. The angles θ and Φ are described in figure 5.20. For example, the number of frames in which the reflection can be seen decreases if the aircraft speed increases. Assume that a solar specular reflection can be seen for 10 frames and the aircraft's airspeed is 160 knots. In a 40 knots tail wind the same reflection will be seen for 8 frames at the same distance. In a 40 knots head wind the same reflection will be seen in 13-14 frames at the same distance.

Consequently, the duration time of a solar specular reflections strongly depends on the reflecting surface properties, the distance to the FLIR sensor and the speed and position of the aircraft. The incident positions of the aircraft determined which reflection cones the FLIR would have passed through and thereby what reflections would be recorded to the FLIR tape.

We all know that the position of the sun varies throughout the day and, therefore, the local time had to be incorporated in the reflection model. During the recording of the FLIR videotapes, the aircraft circled above the complex while the operator maneuvered the FLIR sensor. To deal with the various movements, the relation between the sun, the objects causing the flashes and the FLIR sensor position was modeled in 3D.

The geometrical relation between the pixel intensities, (x,y,t), can be related to the spatial position at the complex, $(X_{world}, Y_{world}, Z_{world})$, by using a suitable camera model, illustrated in figure 5.22 and 5.23. In the case of perspective image projection, the relation between an image pixel (x,y) and the position at the complex can be described as in equation (5) and (6).

$$x = f X_{world} / Z_{world}$$
 (5)

$$y = f Y_{world} / Z_{world}$$
 (6)

f denotes the focal length of the camera. The corresponding camera model is illustrated in figure 5.22. Even if the ideal camera model is mainly a theoretical model, it could be used to reconstruct the FLIR sensor position. The distance between the FLIR sensor and the complex was estimated directly from the images utilizing the FLIR system field of view and some reliable sizes of objects in the depicted scenery of the Branch Davidian complex. Thereby the geometrical relationship between the sun, the complex and the FLIR sensor could be numerically calculated for the flashes in table 2 utilizing specially developed software scripts.

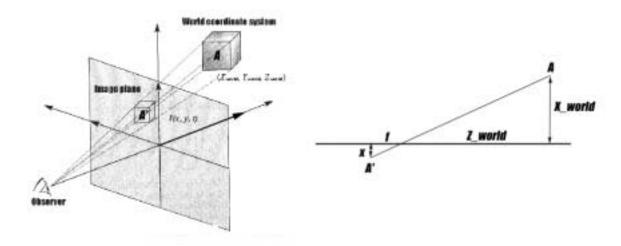


Figure 5.22. Perspective projection (left), initially from [Vince] p. 48, and the corresponding camera model (right).

The FLIR sensor position was estimated without considering the rotational movements of the image plane, which were believed to increase the error in the aircraft azimuth angle relative to the complex. To deal with the rotational movement of the FLIR sensor, MatchMover by Realviz was used to more accurately estimate the FLIR sensor positions. This software inserts virtual objects into a real-world video recording by reconstructing the camera positions. This technique is widely used in the movie industry. In this case only the 3D position of the FLIR sensor camera and the complex coordinates were of interest. The tracked FLIR sensor position from MatchMover and the 3D model was oriented towards North. Finally, the bearing to the sun was added to complete the reconstructed flash geometry.

The calculated distance between the complex and the FLIR sensor position varied. However, the reconstructed azimuth and elevation angles were accurate and reliable. By numerically calculating a set of reference distances from the image of the tower roof in figure 5.18, all tracked distances from MatchMover were calibrated for accurate distances.

The error in the reconstructed flash geometry was estimated to be somewhat larger than it would have been had a staring camera with known focal lengths been used instead of the FLIR system. The errors induced from the tracking procedure were mainly caused by misplacements of the 2D tracking points, see figure 5.23, or from image displacements caused by the FLIR system, illustrated in figure 5.9. By manually calculating the 3D points from the 2D FLIR images and comparing these data to the results, from both methods used for 3D reconstruction, the reconstructed flash geometry proved to be accurate and reliable.

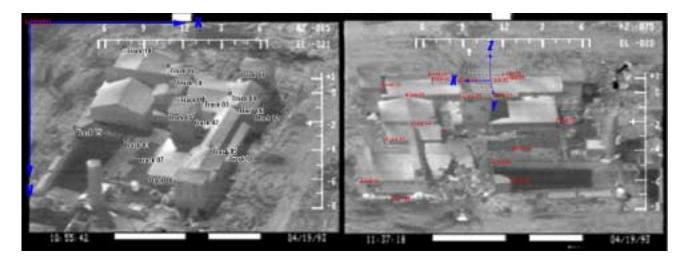


Figure 5.23. Tracked 2D points (left) and the image coordinate system (blue). Corresponding reconstructed 3D points (right) and the ground coordinate system (blue) at the Branch Davidian complex. Note that (X, Y, Z) denotes 3D points at the Branch Davidian complex which are related to the direction from the Branch Davidian complex to the FLIR sensor, $(X_{world}, Y_{world}, Z_{world})$, in the perspective projection model.

In short, there is only one possible reflection geometry per specular solar reflection at the time t. By reconstructing and comparing the reconstructed flash geometry it was possible to verify whether the flashes were of similar geometry, including the variations over time t.

5.5.2 Pre-review of the Flashes on FLIR Videotape Q-4

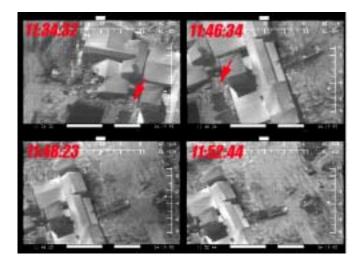
A review of the FLIR imagery was conducted prior to the numerical analysis. The results from the visual reviews of the flashes, the image enhancement, motion analysis and comparison to the complementary imagery were that;

- Event 1 was quite obviously caused by solar specular reflection.
- Events 6 at 11:18:48 and 42 at 11:58:04 were concluded to be only normal thermal radiation from debris/objects set in motion by the CEVs.

These two events, events 6 and 42, have been omitted from the remaining of the analysis.

5.5.3 Flashes in the Courtyard

Events 18 at 11:34:32 and 31 at 11:46:34 were the first to be tracked. To investigate why the flashes were not seen on successive aircraft turns, two additional sequences were tracked for which the positions of the FBI Nightstalker FLIR's field of view were similar to the positions for event 18 and 31.



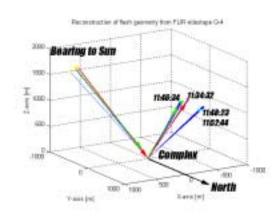


Figure 5.24. FLIR images (left) and the direction of the FBI Nightstalker and FLIR sensor position (right), event 18 at 11:34:32 (red) and event 31 at 11:46:34 (green) and two relative to similar fields of views at 11:48:23 (cyan) respectively 11:52:44 (magenta).

The result clearly shows that the FLIR sensor was at another position relative to the Branch Davidian complex for the latter two turns and that event 18 and 31 were actually very close in similar positions, see figure 5.24. The image planes were rotated in different ways for events 18 and 31, which was mainly caused by different FBI Nightstalker maneuvers. Twelve minutes passed between events 18 at 11:34:32 and event 31 at 11:46:34. The differences in the positions of the sun accurately account for the difference in positions for event 18 and 31. This clearly indicates that both event 18 and event 31 align extremely well to the reconstruction model and proves that the flashes 18 and 31 were caused by solar specular reflections. The size of the reflection cone for event 18 at 11:34:32 was estimated to be of a size of 30 – 45 meters at the FLIR sensor location, which is a very reasonable size for a solar specular reflection at that distance.

The remaining events in the courtyard also aligned well to the reflection geometry. These are events 16, 28, 30, 33, 37, 38, 51 and 54. It was concluded that these flashes also were caused by solar specular reflections. However, as the pulsating nature of the event 51 at 12:08:48 and event 52 at 12:08:51 could not be entirely explained from the reconstructed flash geometry, the appearance of these two flashes were further investigated in section 5.5.7.

5.5.4 Flashes within the Damaged Structure on the Red Tower

Events 2 at 10:54:20 and 4 at 11:14:10 were tracked next. From reviewing the reconstructed data, it was very clear that these two events in the damaged structure of the red tower at the red/white side of the complex were caused by solar specular reflections. Some very small debris probably caused these reflections. The pulsating nature of these flashes was concluded to be a product of the FBI Nightstalker

FLIR system, as explained in section 5.1 and section 5.5.7. Event 24 at 11:42:00-01 was very similar to events 2 and 4 in reconstructed geometry, but originated from another very close position relative to the Branch Davidian complex. Event 24 was probably caused by a closely located piece of similar reflective material. This part of the complex is not in the shadow.

5.5.5 Flashes on the Roofs

All events seen on roofs aligned extremely well to the reflection geometry as well. These events are;

- Events 9, 14, 15, 17, 20, 27, 28 the flashes on the roof, 32 and 35 on the cafeteria roof.
- Events 10, 11, 21 and 53 on the roof of the chapel. Event 53 at 12:09:00 was also analyzed in depth in section 5.2.
- Events 25, 26, 29, 34, 36, 39, 40, 41, 43 and 46 on the single storey roof on the white side.

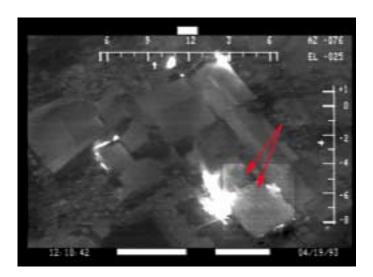


Figure 5.25. Several hot spots on the cafeteria roof, 12:10:43 (highlighted square and at red arrows and other locations on the roof).

It was concluded that the events from 12:10:48, including the flashes in the courtyard and also event 57, were caused by heat reflections from the fire, even if solar specular reflections were believed to have contributed to causing some of the flashes. A large number of bright spots were detected on the cafeteria roof at this time, around 12:10:43, see figure 5.25, which coincided with the positions of the flashes on the cafeteria roof.

As no human-like activity was detected on any of the roofs, except event 56, and based on the

results from the image enhancement and motion analysis, and as all the events on the cafeteria, chapel and single-storey roofs aligned to the reflection geometry, it is concluded that the flashes on the roofs were caused by solar and heat reflections.

5.5.6 Flashes at Other Locations

Based on the results from the reconstructed flash geometry that aligned well to the reflection geometry, the results from visual reviews, image enhancements and the fact that there was no detected activity near any of these flashes, events 3, 7, 13, 22, 23, 11:42:32, 44, and 45 were also concluded to be caused by solar specular reflections. Event 13 at 11:28:04 was caused by at least two objects.

Event 5 at 11:18:21 was a flash from a CEV that was moving when the flash appeared. This flash was subject to an in depth review and image enhancement in section 5.2. This event was also similar to the sighting at 12:09:59. These two flashes appeared similar in their size relative to the CEV and they were both horizontally shaped. Based on these results and also from comparison to the other flashes, it was concluded that these flashes were caused by solar specular reflections.

Event 8 at 11:24:30 – 32 consisted of pulsating flashes from two close positions on the ground at the black side close to the demolished gym. At 11:24:35 heat combusts from the CEV was seen. Even thought there was a striking resemblance between those pulsating flashes and the flashes on FLIR videotape Q-4 that already were concluded to be solar or heat reflection, event 8 was further investigated in section 5.5.7. The pulsating flashes, event 12 at 11:26:27, were also further investigated.

Long duration flashes, like event 50 at 12:08:31, seen on the black side in the debris appeared only once. At 12:04:37 the CEV penetrates the gym at the black/red corner and the catwalk can be seen falling down to the ground. At 12:04:41 what is believed to be a window falls on the ground, which later is in the same position as is for the long duration flashes at 12:08:31. This flash was confirmed to be a window and can be seen in one of the ground view photos, figure 5.26.

At 12:06:33 and 12:10:35 no such flashes were seen even if the sensor position appears to be similar. When numerically compared the FLIR sensor position differed, figure 5.27. At 12:10:35 the sensor position was closer, but still different. This explains the lack of reflections at 12:06:33 and 12:10:35. Similar long duration flashes during the Fort Hood flight trial video, (app. 2 item 17), for example at 11:05:08, 11:16:33 and 11:17:49 are seen from the debris area, figure 5.28. Event 50 was also analyzed in depth in section 5.2. It was concluded that event 50 was caused by solar reflections from large pieces of glass.

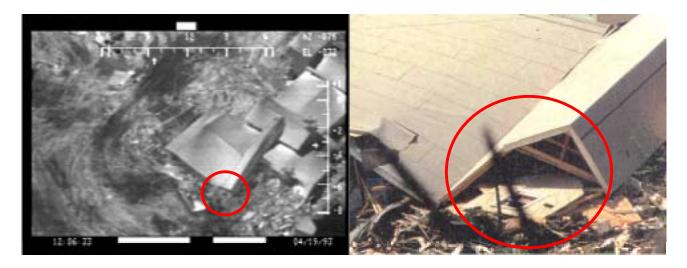


Figure 5.26. The window from the demolished catwalk.

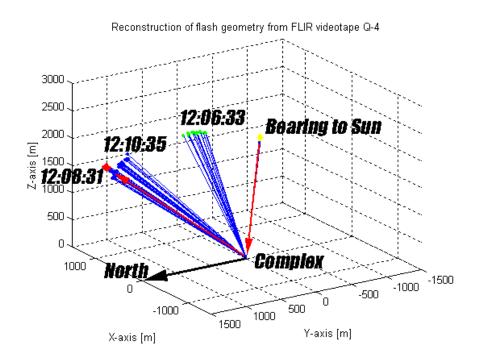


Figure 5.27. Event 50 at 12:08:31 tracked (red and red arrows) and compared FLIR sensor fields of view at 12:06:33 (green) and 12:10:35 (blue).



Figure 5.28. Debris causing reflections during the Fort Hood flight trial on the Lynx FLIR imagery. A flash that was small, elongated and short in duration (left) and a flash that was larger and longer in duration (right).

5.5.7 Appearance of Flashes

This section analyses the remaining flashes from the previous sections 5.5.3 and 5.5.6 in depth, by also taking into account the characteristics of the FLIR system and by comparing the flashes on the FLIR videotapes to the flashes seen on the imagery from the Fort Hood Flight trial, March 19, 2000. The remaining events were; event 8 at 11:24:30—35; event 12 at 11:26:27; event 51 at 12:08:48; and event 52 at 12:08:51. The aim was also to investigate any similarities between the analyzed flashes on FLIR videotape Q-4 and the muzzle blasts flashes seen on the videotapes from the Fort Hood flight trials March 19, 2000. The following data was reviewed: the trial imagery, protocol and report, Nightstalker FLIR videotape (app. 2, item 16), Lynx FLIR videotapes (app. 2, items 17-18), photos (app. 2, items 37-41), flight trial protocol (app. 2, item 68) and "Imagery Analysis report FLIR TRIAL Fort Hood, Texas 19 March 2000" in (app. 2 item 65). Noted was that (app. 2, items 17-18) were converted from PAL to NTSC, which have been considered in the investigation.

The results from an initial visual review was that the muzzle blast flashes that could be detected on the Fort Hood FLIR videotapes were different in appearance than the solar reflections in the debris area from the same videotape. The detected muzzle blast flashes on the Fort Hood trial videos were also different in appearance compared to the flashes seen on FLIR videotape Q-4, one example is shown in figure 5.29. Moreover, the flashes on FLIR videotape Q-4 were very similar in appearance to the solar reflections in the debris area from both the Fort Hood Lynx and Nightstalker FLIR videotapes, illustrated in figure 5.28. Noted was the similarity in the flashes horizontally elongated shape.

Pulsating solar reflections were detected on the Fort Hood Nightstalker videotape in the debris area. These pulsating solar reflections were similar to the pulsating flashes on FLIR videotape Q-4. Event 8 at 11:24:30 – 35, event 12 at 11:26:27 and the flashes from 12:08:48 and onwards, including event 57, on FLIR videotape Q-4 were compared to the pulsating solar specular reflection flashes recorded by the Fort Hood FBI Nightstalker. The visual review confirmed that events 8, 12, 51 and 52 on the FLIR videotape Q-4, were similar in appearance to the pulsating solar reflections in the debris area on the Fort

Hood trial videos, one example is shown in figure 5.30. Heat combust from the CEV can, however, have contributed in creating the flashes at events 8 and 12.

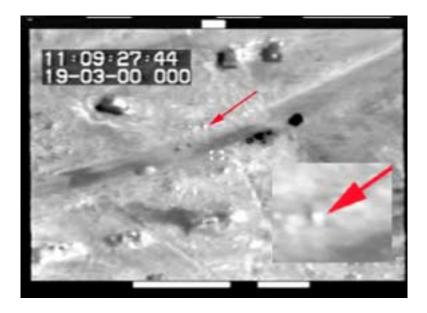


Figure 5.29. Muzzle blast flash (red arrow) from the Fort Hood FBI Lynx videotape and a highlighted enlargement of the same region.

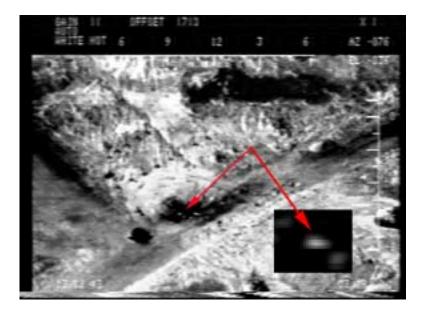


Figure 5.30. An illustration of pulsating flashes (red arrow) at the Fort Hood FBI Nightstalker videotape, enlarged in the lower right part of the image.

At 12:08:48, including event 57, several flashes appear from the same position in the courtyard near what once was the gym. From 12:10:48 onwards, multiple flashes are seen from that same position. The flashes from this position appear in one single horizontal line, regardless of the FBI Nightstalker's circular movement. This was verified by analyzing these flashes utilizing the analyzing system's built in waveform monitor. The object that caused the flash was obviously less than the size of the vertical resolution. It was concluded that the FLIR system smeared the flashes seen from 12:10:48 onwards, in the images horizontal direction. This effect was investigated in depth in section 5.1.2, see figure 5.7. The flashes from 12:08:48 and onwards, including event 57, from this position were concluded to be mainly reflections caused by heat from the fire, however, solar specular solar reflection cannot be entirely excluded.

Efforts were made to further determine the phenomena, beside multiple objects, that could cause the pulsating nature of the flashes seen on the FLIR respective to the Fort Hood videotapes. Measuring exact duration times from video is close to impossible for short duration flashes that are seen in one field or those appearing intermittent in multiple fields as pulsating flashes. Thus, counting fields does not, by itself, provide enough parameters to identify events from the FLIR videotape such as a small arm muzzle blast.

An object with a sharp horizontal edge might very well be presented in one field, but not in the next. This phenomenon is in the literature referred to as "twitter" on fine vertical details, [Watkinson]. Quantifying effects are known to cause variations in the image intensity, particularly when the size of a reflecting object is less than the FLIR system's spatial resolution. Such a small object can align well within one detector element, figure 5.2. For a high-energy flash like solar reflections, the pixel values will then be saturated, unless affected by limitations in the bandwidth of the video system. A small object might also fall between two elements in the vertical direction during parallel scan, see figure 5.2, and thereby become more or less invisible; or fall onto two (or more) detector elements and thereby become represented by two or more scanned lines. In these latter two cases, the pixel values will become a mixture of the object's and the surrounding background's thermal radiation.

The object can also fall on the edge between serial scans. This can affect the image intensity of the object, but also cause displacement of the representation of the object in the image as analyzed in section 5.1.3, figure 5.9.

Event 44, for example, is not of a pulsating nature. This flash was represented either as a rectangle in only one video line, or as a more diffuse rectangle that spanned several video lines, figure 5.31. The same effect appeared for larger flashes on FLIR videotape Q-4, but at the edges between the object and the background. Measuring the variations in intensity profile for several of the larger flashes verified this phenomena. According to the SPRITE tentative data in [Philips], the SPRITE/TED vertical element width is $62.5 \,\mu m$. The exact size of the gap between the detector elements of this particular FLIR was unknown, but according to [Philips] this gap is about $12.5 \,\mu m$ or about 20 % of the vertical size of the SPRITE/TED

element. Phenomena that also can affect the appearance of small or distant objects are non-uniformity in signal processing within the FLIR system, described section 5.1.3, [Cuthbertson] and [Philips].

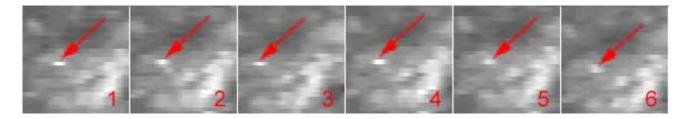


Figure 5.31. Event 44 at 12:00:40, six consecutive image fields with the flash represented by a varying number of video lines.

The effect of these phenomena can be illustrated by event 52 at 12:08:51, which is fixed in position relative to the Branch Davidian complex. The FLIR sensor moved significantly causing motion in the image. Tracking the flash showed a significant vertical motion in the image and thereby the thermal radiation was projected onto one or several consecutive detector elements, on the gap between two elements or between scans, illustrated in figure 5.32.



Figure 5.32. Vertical image motion for event 52 at 12:08:51 that is fixed in ground position, initial position (red arrow) and the trace (yellow dotted line) of the flashes from FLIR sensor movements.

Transient noise or electro-magnetic interference (EMI) from the aircraft avionics, connection cables and improper shieldings also cannot be excluded as factors contributing to image distortion. However, these kinds of image noise and distortions are unlikely to have had any significant impact on the flashes on FLIR videotape Q-4 due to the nature of the flashes.

In short, it is concluded that multiple reflecting objects can cause flashes of a pulsating nature. The result from comparing the analyzed flashes on FLIR videotape Q-4 to the flashes on the Fort Hood flight trial imagery confirmed this.

It is also concluded that the FLIR system and the video system can, and does, distort small objects of a high thermal energy and of a short duration time. Consequently, the SPRITE/TED detector, its scanning mechanisms, and the interlaced video format contributed to the intermittent and pulsating nature of the flashes on FLIR videotape Q-4. These effects, in combination with reflections from one or several close objects, or movements of reflecting objects, all contributed to the pulsating reflections. Complex combinations of these effects have most likely occurred.

Based on this results, it was concluded that event 8 at 11:24:30 - 35, event 12 at 11:26:27, event 51 at 12:08:48 and event 52 at 12:08:51 on FLIR videotape Q-4 also were caused by solar or heat reflections.

5.5.8 Experiments

To verify the results from the 3D reconstruction of the reflection geometry a test was performed utilizing a ThermaCAM PM595 IR camera from FLIR Systems, Sweden. The purpose was to further prove that systems like the FBI Nightstalker FLIR system, in fact, could capture solar specular reflections. The ThermaCAM operates in the spectral far IR band at $7.5-13~\mu m$ similar to the FBI Nightstalker FLIR sensor. The camera operates in the temperature range -40° to +120° C.

On July 25, 2000, around noon, a small masked mirror, less than 1 cm², was placed on a tripod and in a fixed position. This resulted in a very limited spatial distribution of the specular reflection. At a fixed $y\approx 17$ m the distribution cone was estimated to be ± 0.15 m in x- and z-axis direction, figure 5.33.



Figure 5.33. To the left is a ThermaCAM image taken at 12:14 p.m., where the specular solar reflection was captured. In the middle image, taken less than a minute later from another position at the about the same time, no visually detectable reflection was detected. To the right is a plot of the geometrical relation between the positions of the mirror, ThermaCAM camera and sun.

The solar specular reflection was located visually and captured by the ThermaCAM camera. Solar specular reflections were located and captured at 12:14 p.m. and could not be detected at any nearby position outside the distribution cone. The geometric relationship between the positions of the mirror, bearing to the sun, and the camera position were reconstructed, see figure 5.33. The positions of the sun and the camera position were reconstructed in the same manner as for the images from FLIR videotape Q-4. The results from the tests proved that the solar reflection could be detected in the far IR band. It further confirmed that solar reflections could be detected in the far IR band only within a limited distance from the reflection angle.

Solar specular reflections were further located and captured at 12:17 p.m. and later at 1:23 p.m. The geometrical relationship between the position of the mirror, bearing to the sun and camera position were reconstructed, figure 5.34. This result verified that the reflection geometry varies with the position relative to the sun in the same way as for the analyzed flashes on FLIR videotape Q-4.

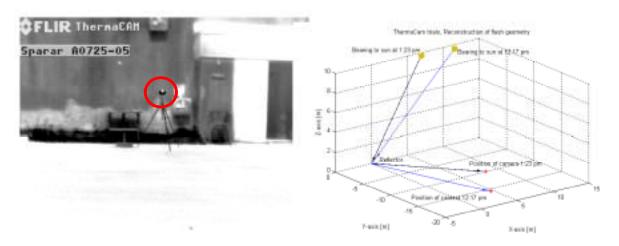


Figure 5.34. To the left is a ThermaCAM image taken at 12:17 p.m., in a position where the specular solar reflection was captured. To the right is a plot of the geometrical relation between the positions of the mirror, ThermaCAM camera and sun.

5.5.9 Results

Events 6 and 42 were only normal thermal radiation from debris/objects set in motion by the CEVs and were omitted from the remaining of the analysis of the flashes.

Based on the results from the visual reviews, the correlation of reconstructed data to the physical laws of solar specular reflection geometry, the fact that several long duration flashes fluctuate in intensity near their peak values, the lack of persons on the roofs and in other areas proximate to the flashes, and the results from the experiment, it is concluded that all of the analyzed flashes were caused by solar or heat reflections.

The sun appeared from under the clouds at the time FLIR videotape Q-4 was recorded on April 19, 1993. There was a lot of broken glass and other kinds of reflective debris from the demolished complex that was not present before April 19, 1993. The objects that caused the reflections were in many cases also seen from the other directions as "cold" objects. Several of the objects were also identified from the complementary duplicate photos and videotapes. Reflection cones have been reconstructed from FLIR videotape Q-4, in a variety of different directions as a result of the many different orientations of the reflecting surfaces. During the time FLIR videotape Q-4 was recorded there were probably several more reflection cones in space than the ones determined from FLIR videotape Q-4. Occasionally, the FBI Nightstalker flew through some of these rays of distributed solar specular reflection that appeared within the range of the aircraft's operating altitude. The strong wind contributed in causing the flashes to appear on an intermittent nature, as the aircraft drifted off from an ideal flight path. Quite simply, the FBI Nightstalker did not pass through all the possible reflection cones existing on April 19, 1993. If it had the number of flashes on FLIR videotape Q-4 would have increased.

5.6 Image Processing for Fire Investigation

The image processing of the Branch Davidian complex fire sequences from the April 19, 1993, FLIR videotapes were done in cooperation with Professor Ulf Wickström, SP, Swedish National Testing and Research Institute, Borås, Sweden. This section describes the approach to processing the FLIR videotapes from April 19, 1993. The results of this analysis have been provided to Professor Ulf Wickström for his analysis of the fire development. Besides discussing the matter by phone and e-mail conversations, meetings were held on three occasions, May 16 and July 13 in Linköping, Sweden, and June 27 in Borås, Sweden. The result from the tracking, pseudo-coloring and temperature measurements were presented and reviewed at these meetings. During these meetings duplicate photos and media footage were also reviewed.

To enhance the visibility of temperature variations on the building before and during the initial phase of the fire, a sequence of 25100 digitized images within the time interval 11:57:03 – 12:11:04 were pseudo-colored. One field per each frame was used to limit the motion blur that frequently disturbs the image quality caused by the interlaced video format. Pseudo-coloring is a process by which the shades of grey within the FLIR image are assigned colors. Because the human eye can not fully resolve small quantitative difference between the shades of grey depicted on the screen, pseudo-coloring can successfully be used to assist the eye to detect small objects or resolve temperature differences in the thermal images. When an object on the FLIR imagery increases in temperature, its shade of grey will become lighter. These small changes in temperature are, to some degree, easier to track when using the pseudo-coloring process, where the human eye could not detect the small change in grey levels.

However, the automatic gain and bias control of the FLIR caused rapidly changing variations in the grey scale, as mentioned in section 5.1. As a result, areas of uniform temperature do not always correspond to the same grey level intervals in the FLIR imagery. To overcome this problem, the sequence

was preprocessed. Four regions of interest were tracked, see figure 5.35, in which the temperature variations were assumed to remain relatively stable. As the fire spread, the central tower roof and the lawn in front of the central tower increased in temperature, measured relative to the water in the pool. The temperature of the water surface remained stable within the tracked time interval and was used for normalization of the gain variations. Normalization is here defined like in [HolstIR], as the "process of reducing the measurements as nearly as possible to a common scale".

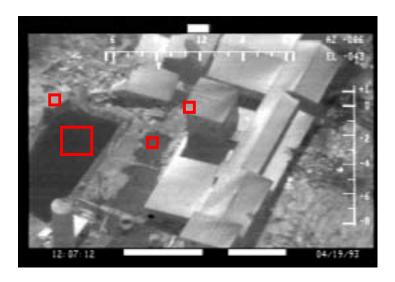


Figure 5.35. Selected regions for normalization of grey levels illustrated in one of the frames, on the platform near the swimming pool, on the central tower roof, on the lawn in the courtyard and on the water surface in the swimming pool. An additional area was tracked on the soil of the red side.

This simplified normalization procedure adjusted the pixel values in the images according to the average intensity of the water surface. One field per 100 frames was tracked, except for 12:05:29 – 12:06:31 where each 50th frame was tracked. For the untracked fields between the tracked fields, the estimated pixel intensities were obtained from interpolation. The variations in the average grey levels for the four regions are shown in figure 5.36. Using this simplified normalization procedure, the variations caused by the automatic bias control were reduced, but not fully removed. The automatic gain function was also not fully corrected. Yet another region was tracked on the soil of the red side and some modifications of the normalization procedures were made to equalize the bias. The modified normalization procedure was applied for the interval 11:57:00-12:06:31. The remaining variations caused by the automatic bias and gain functions were determined negligible and not to have impact on the reliability of the results.

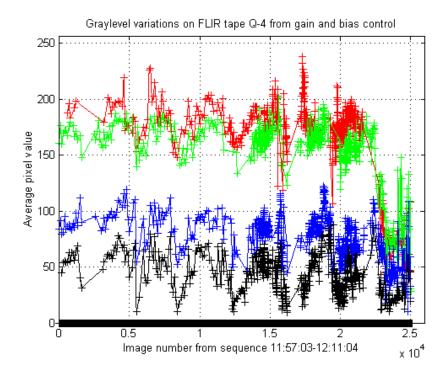


Figure 5.36. Variations of the average grey level of the tracked regions, as an effect from automatic gain and bias control of the FLIR at 11:57:03-12:11:04.

Finally, the sequence was pseudo-colored in three different ways, for both the unprocessed and the normalized sequence. First, a color-map was chosen to pseudo-color all grey levels. Second, the same color-map was used to pseudo-color only the highest temperature interval in the FLIR images. The third method applied red for the highest temperature interval in the FLIR images. The three pseudo-coloring techniques were applied both on unprocessed as well as processed sequences. Figure 5.37 shows some examples from the unprocessed and the pseudo-colored sequences.

The rather immediate outcome of the tracking and pseudo-coloring was the observations of heat on the white side of the red tower, the catwalk and the cafeteria.

To further analyze the temperature variations at lower intensity levels, a simple method was developed to detect a raise in temperature rather than just saturated pixels. From the first visible heat source, the FLIR sequences were tracked backwards in time until it was unable to detect the heat visually. An area to measure the image intensity was then selected where an intensity profile was created for several selected occasions. The occasions were selected based on the FLIR sensor field of view. Ten intensity profiles were created from consecutive images at each selected time. The intensity profiles were finally averaged to remove system noise. As a result, the relative variations in temperature could be compared over time. From figure 5.36 it was assumed that the variation caused by the automatic gain control had

impacts on the measured values, which had to be considered when interpreting the results. However, the impacts are not assumed to threaten the reliability of the result.

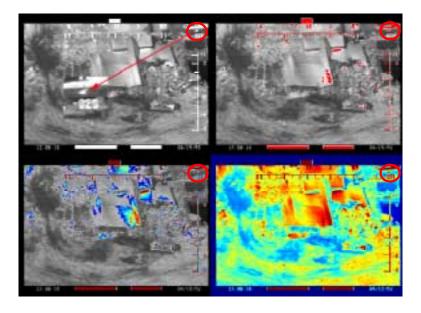


Figure 5.37. Detected heat sources at 12:08:10 (red circles), unprocessed (upper left) and enlarged (red arrow), and images pseudo-colored in three different ways (upper right, lower left and lower right).

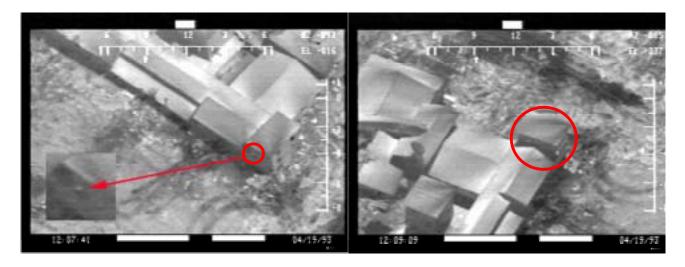


Figure 5.38. Detected hot spots in the red tower 12:07:41 (left, red circle and enlarged) and 12:09:09 (right, red circle).

5.6.1 Red Tower

A heat source was detected from the pseudo-colored sequence at 12:07:41, in window B14 on the white side of the red tower. No significant variation in image intensity was detected on the white side wall of the tower before that, but was clearly seen when the white side appeared again in the FLIR field of view at about 12:09:09 figure 5.38.

5.6.2 Catwalk Roof

At the eave of the shaded side of the catwalk roof, a heated area was detected from reviewing the digitized FLIR sequences, faintly at 12:04:21 and 12:05:13 and more clearly at 12:06:13. The bright spot on the eave of the catwalk roof increases in heat until 12:10:21 when heat clearly were seen emerging from the catwalk and gym area.

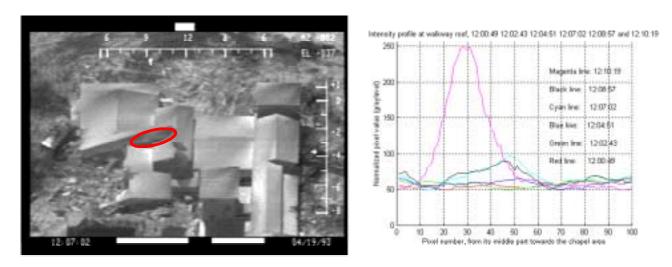


Figure 5.39. To the left a hot spot at the eave of the catwalk roof with the position for the measured intensity profile. To the right a plot of the measured temperature differences.

The relative difference in temperature was measured on a two-minute basis, utilizing the method described earlier. The decision to measure on a two-minute basis was simply motivated by the fact that the catwalk roof was not horizontally aligned on the FLIR images. In practice, measuring the intensity profiles from varying image directions would have increased the measurement error. Lower intensity values corresponding to unheated parts of the catwalk roof were assumed to be relatively stable in temperature and used to normalize the intensity profiles to approximately the same bias. According to the measured values, the first significant raise in temperature appears at 12:04:51, see figure 5.39. The first indication of increasing heat at the eave of the catwalk roof was verified by additional measurements utilizing a waveform monitor to measure the intensity profiles, but only when the roof was aligned to the images in the vertical direction. The result from this was that the heat increase on the catwalk roof was detected even earlier, at 12:04:05.



Figure 5.40. Duplicate photo of the demolished catwalk, taken from the black side.

Duplicate photos from the black side of the Branch Davidian complex were reviewed. One picture shows a fire in the structure towards the stage area at the rear of the chapel, see figure 5.40. It is reasonable to assume that this picture was taken after 12:04:43, as this is the time when the catwalk roof has fallen onto the ground but before 12:10:21 when heated plumes emerged. No CEV was detected in the picture. As a CEV are seen leaving the gym area at about 12:09:00 it is reasonable to believe the picture was taken some time between 12:09:10 and 12:10:21.

5.6.3 Cafeteria

A bright spot was detected at 12:08:10 on the pseudo-colored sequences, near the door into the cafeteria on the black side of the Branch Davidian complex, see figure 5.41. Later at 12:08:26, two heat sources were also detected, figure 5.41 and 5.37.

No detectable raise in temperature was detected at the cafeteria roof, neither from measuring the image intensities on the wall nor on the roof, see figure 5.42. Although some variations were measured, it could not be deduced whether heat or other phenomena, such as noise induced by the FLIR system, insufficient spatial resolution, or thermal sensitivity caused these deviations.



Figure 5.41. Hot spots near the door into the cafeteria at 12:08:10 (left) and 12:08:26 (right).

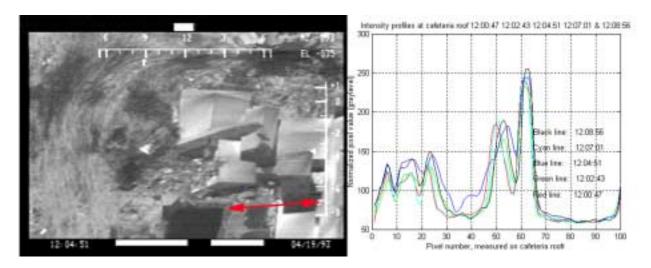


Figure 5.42. To the left is the cafeteria roof with the position for the measured intensity profile. To the right is a plot of the measured temperature differences.

6. VIDEO AUTHENTICATION

Recording an analog video signal is a very complex process. This section contains a short tutorial on video technology to introduce some of the parameters used for investigating whether videotapes are original, authentic, or have been technically manipulated. This section will further explain how the analysis was carried out on the April 19, 1993, FLIR videotapes, and the conclusion of that analysis.

6.1 Video Format

6.1.1 Picture Reproduction

The visible screen on a FLIR system is built up of images called frames. These frames are quickly and sequentially exposed to the viewer, much like the frames playing through a projector shutter in a movie theater. In a television system, each frame is captured and reproduced by horizontal scanning lines. In a NTSC television system, used in North America and East Asia, new frames occur at a rate of 30 per second. The number of horizontally scanned lines in each frame is 525. To reduce the gap between the scanning lines on a screen and to reduce flickering, each frame is scanned twice into two separate fields that are shifted vertically with the height of half a scanning line as shown in figure 6.1.

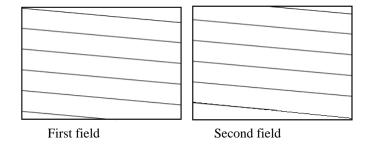


Figure 6.1. Illustration of the difference between the two fields in one frame.

The first field begins with a full line and ends on half a line. The second field starts with a half line and ends with a full line. Each field will contain 262.5 lines and the fields' repetition rate is about 60 Hz or 60 fields per second. However, neither all the lines, nor the entire part of a line is used to carry the picture information. The standard number of lines used for picture information in a frame is 485. The line period is 64 μs, for which 52 μs is used as picture space. In this case, the number of lines used for the thermal imagery from the FBI Nightstalker FLIR sensor is about 416. There are several different video system in use around the world, and the FLIR system is designed to RS-170 that is an EIA standard for 60 Hz monochrome (grey scale) video. RS-170A (SMPTE 170M) is the standard for 60 Hz color video (NTSC). In Europe, the most commonly used system is PAL. The main difference between NTSC and PAL is that PAL in Europe has a 50 Hz field rate, 25 Hz frame rate, and 625 lines in each frame, and 312.5 lines in each field. The system for color reproduction is also different for NTSC and PAL. The frame and field rate of RS-170 and RS-170A that are commonly specified as 30 respectively 60 Hz, are in

fact 29.97 respectively 59.94 Hz. Specifications for different video systems can be found in ITU-R (formally CCIR) reports.

A normal TV set or a low-cost monitor will not display the entire picture due to over scanning. The amount of picture information that is outside the visible area depends, for example, on how well the monitor or TV set is aligned. As a result, there is picture information just outside the visible screen. In the forensic case, the "hidden" information can be of great importance. There are also computer frame grabbers and other digitizing products on the market which have limitations in capturing the full picture area.

6.1.2 Video Signal

The video signal itself is a continuous stream of complex information, which contains a wealth of information that needs to be distributed. For example, the illumination level, vertical (field/frame) synchronization, horizontal (line) synchronization and in the case of color reproduction, color information and color synchronization are contained in the video signal. Every new field starts with a vertical synchronization pulse. Between two consecutive vertical synchronization pulses, there is 262.5 horizontal synchronization pulses. Every line starts with a horizontal synchronization pulse. Between two consecutive horizontal synchronization pulses there is image information.

The standard level of video signal used by video equipment is 1-volt peak to peak, where both vertical and horizontal synchronization signals are pulses between 0 and 286 mV. The image information has an amplitude variation from 286 mV to 714 mV, where 286 mV is black information and 714 mV correspond to 100% white. The synchronization signal is thereby distributed at a level that is lower than black image information, and serves not only as reference to a new field or a new line, but also as a level reference for the luminance information. It is very important that the above mentioned relationship between synchronization and video signal is kept unchanged through a distribution chain, or through a copying process. If the synchronization signal is restored with a different level, for example by using misaligned mixers or time base correctors (TBC), or if the synchronization level has been changed by any other external processing, it will affect the level of the video signal. Consequently the original video signal level will not be correctly represented in captured or digitized video, if the synchronization level has been changed.

6.1.3 Recording of Video

Analog recording of a video signal is performed in a different way than analog recording of audio signals. This difference is due to the higher bandwidth needed for video signals. The main difference in mechanical arrangements is that the video signal is recorded or played back by two record/playback heads. The record/playback heads are mounted on the periphery of a rotating drum, on opposite sides, figure 6.2. When the videotape is loaded into the mechanism, it wraps a little bit more than halfway around the drum as shown in figure 6.2.

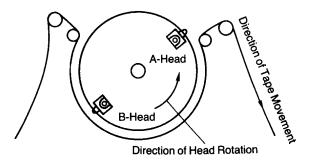


Figure 6.2. Helical scanning, from [Panasonic, Basic video guide] p. 7.

During recording, the rotation of the drum is locked in speed and phase to the actual frame-rate of the supplied video signal. In case of NTSC, for which the frame rate is about 30 Hz, the drum will make 30 revolutions per second. Thus, one revolution will correspond to two fields. The drum is also angled so that half way around the drum corresponds to approximately the width of the videotape, as showed in figure 6.3. This angle between the drum and the videotape is called helix angle.

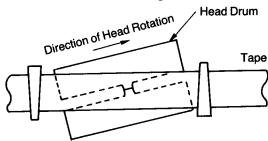


Figure 6.3. Helix angle, from [Panasonic, Basic video guide] p. 7.

The resulting recording of the video signal on the tape will be diagonal tracks as shown in figure 6.4. Each track starts with a new field only if the drum is synchronized at a correct speed and phase during recording. Since the videotape wraps a little bit more than halfway around the rotating drum and the video heads are connected in parallel during recording, each track will end with the same information as the next track starts with. The recorded signal on these tracks is a Radio Frequency (RF) carrier that is frequency modulated (FM) by the luminance part of a video signal. Under normal circumstances there is also a chrominance part to record, and this chrominance signal is distributed as a carrier in the composite video signal. This chrominance carrier will be down converted by electronics inside the video machine from 3.58 MHz (NTSC) to 627 kHz. The converted signal will be used by recording circuits to amplitude modulate the luminance RF-signal.

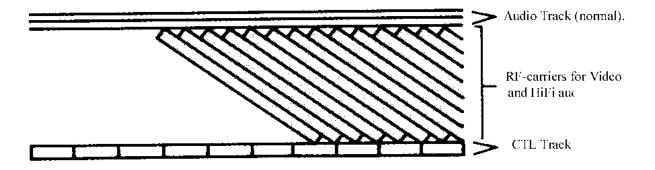


Figure 6.4. Tapepath, from [Panasonic, Basic video guide] p. 9.

In this case, when the video signal was generated by the FBI Nightstalker FLIR system, the FLIR sensor information was recorded as luminance signal. The frequency of the RF-carrier varies between 3.8 MHz and 4.8 MHz, where 3.8 MHz represent the lowest level (0 volt) and 4.8 MHz the highest level (1 volt) of the video signal that modulates the carrier. "Black" in an FLIR image will correspond to approximately 4.0 MHz.

During recording, a Control signal (CTL) is created from the video signal's vertical synchronization of the first field in a frame, and formed into a square wave signal, that is recorded into a longitudinal CTL-track into the lower edge of videotape, figure 6.4. During playback the CTL-pulse serves as a reference for the drum servo circuit, which will cause the video heads to match the recorded track on the videotape. The recording format of a CTL-track is similar to a normal audio track, but the CTL-track is recorded without a bias current. Thus, the recording of a square wave will end up as spikes. A typical playback CTL-pulse is illustrated in fig 6.5.

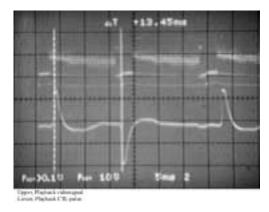


Figure 6.5. Playback CTL-pulse from videotape Q-4 playback video signal (upper) and playback CTL-pulse (lower).

If a video machine is equipped with a hi-fi track for high quality audio reproduction, there are two more recording/playback heads mounted on the video drum. Those extra heads are used for two frequency modulated RF carrier signals, which are required for recording and playback of high quality audio. The carrier frequency specification for VHS format in NTSC television-standard is 1.3 MHz for left channel audio and 1.7 MHz for right channel audio. Recording these RF-carriers deep into the magnetic coating of a videotape, before recording the RF-carrier that contains the picture, will result in a layer that is permanent and not erased by the recording current of the picture signal, figure 6.6.

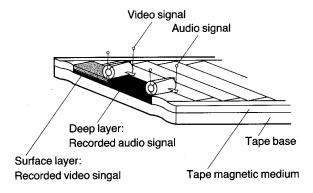


Figure 6.6. Deep modulated FM layer from [Panasonic, Basic video guide] p. 8.

6.2 Analytical Methods

One of the two main parts of this investigation was to determine whether the April 19, 1993, FLIR videotapes Q-1 – Q-7 are original and authentic. To answer this question the following electrical signals have been analyzed to determine if there has been any kind of alteration of the FLIR videotapes, and also to ensure that a single recording source was used for each FLIR videotape;

- RF-envelope for the video signal.
- RF-signal carrier for video signal.
- RF-envelope for FM-audio signal.
- RF-signal carrier frequencies for FM-audio signal.
- Dihedral error.
- CTL-pulses.

A visual inspection of the playback picture on the FLIR videotapes was also performed.

No attempt was made to expose the magnetic layer on FLIR videotapes as this might damage the videotapes.

6.2.1 RF-envelope for the Video Signal

This is the playback RF signal for one drum revolution exposed on an oscilloscope. Each video recorder has a slightly different helix angle and recording current. This will cause variations in the playback RF envelope and level if different video machines where used to record a videotape. These machine specific differences are identifiable in the playback RF envelope. A typical view of the playback RF-envelope from FLIR videotape Q-1 is seen in figure 6.7.

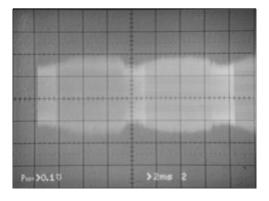


Figure 6.7. Oscilloscope picture viewing playback envelope from FLIR videotape Q-1. The picture shows the signal from one drum revolution, the head switch occurs in the middle of the picture.

6.2.2 RF-signal Carrier Frequency for Video Signal

The RF-carrier frequency can vary between 3.8 MHz and 4.8 MHz. 3.8 MHz represents the lowest part of the video signal and has been used for analyzing the FLIR videotapes.

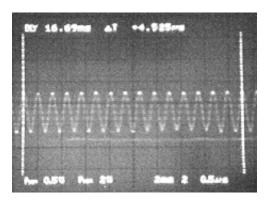


Figure 6.8. Oscilloscope picture viewing the RF-carrier from FLIR videotape Q-6. The picture is

captured during a vertical synchronization pulse, where the RF-carrier is nearly stable.

A typical view of the playback RF-carrier from FLIR videotape Q-6 is seen in figure 6.8.

Adjustment for this RF-carrier is done when manufacturing and also during service. This RF-carrier is seldom adjusted by anything more sophisticated than a potentiometer, and the precision is approximate. The lowest stable frequency available for examination occurs during the vertical synchronization area of the video signal. By using an oscilloscope to capture several cycles of the RF-carrier during vertical synchronization it is possible to calculate the frequency, and detect changes that could indicate a different recording video machine.

6.2.3 RF-envelopes for the FM-audio Signals

These two signals were treated in the same manner as the RF-envelope for video signal. A typical oscilloscope view showing audio RF-envelopes are in figure 6.9.

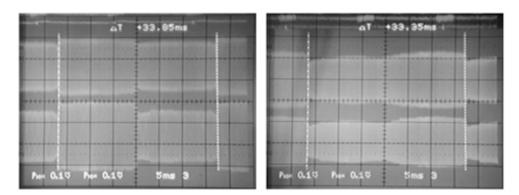


Figure 6.9. Oscilloscope picture viewing audio RF-envelope from videotape Q-3 and Q-4. The upper signal is from left channel, and the lower signal is from the right channel. Between the cursors there are one drum revolution, and in the middle of each picture the heads are shifted.

6.2.4 RF-signal Carrier Frequency for the FM-audio Signal

The RF-carriers were monitored with a frequency counter during playback. The purpose was to detect variations in the carrier frequencies that could indicate different recording equipment.

6.2.5 Dihedral Error

During recording, the record/playback heads are connected in parallel. In playback mode the heads must be electronically shifted when one track has been scanned. The head switch is adjusted in a playback video machine to occur at the end of a track, in a portion similar to the beginning of the next track. This position is just outside the visible area of the screen, at the end of a field to avoid picture disturbance.

Since every recorded video-line only corresponds to 0.685° of a drum revolution, the heads on the video drum needs to be mounted in a precise manner to keep the signal as accurate as possible to allow accurate playback by different video machines. The difference error is normally about 0.01°. A misalignment between different video machines of the head mounting position on the drum by 0.1° from 180° gives a time shift to the video signal in the head switch point of about 20% of the picture width.

Measuring this time shift during playback of a questioned videotape gives a signature that is related to the difference between the recorder machine and the laboratory machine. It is normal that there are variations in this time shift during playback of a videotape. These variations normally depend on ambient temperature, back-tension fluctuations and tape friction among other factors. These changes vary at a slow rate. This method is the most effective test that can be used to track a master recording video machine from a second generation copy. A switch signature from the head switch is added to the video signal during playback. During additional copying processes, these additional switch signatures will be recorded to the videotape. The number of switch signatures will then normally indicate the number of copying processes, the copying order. A typical view showing the results created by a dihedral error is in figure 6.10.

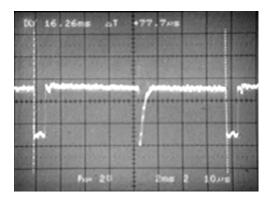


Figure 6.10 is an oscilloscope picture viewing the video line where the head switch occurs. The line period has been expanded from 64 μ s to 77.7 μ s, caused by the difference between the recording and the playback video machine. The cursors are adjusted to the falling edge of horizontal synchronization for measuring the line period, and in middle of the picture there is a glitch from the head switch.

6.2.6 CTL-pulse

The parameters examined were; the duty cycle, pulse level, rise and fall time, time between CTL-pulses and vertical synchronization pulses. Different manufacturers use different values for the duty cycle within different types of video recorders and there are often differences in the rise and fall time between different models. Variations during playback are normally dependent on ambient temperature, back-tension fluctuations, and tape friction. However, this change occurs slowly without any step functions. Typical CTL-pulses are shown in figure 6.11.

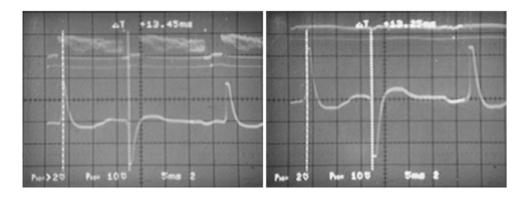


Figure 6.11. Oscilloscope pictures viewing typical CTL-pulses from FLIR-videotape Q-3 (left) and FLIR-videotape Q-6 (right).

6.3 Preprocessing

Each tape was copied onto a working copy tape for use in some of the measurement procedures. These working copies recorded the video signal and two hi-fi sound tracks. The ordinary longitudinal soundtrack was omitted as Mr. Chris Mills, Network International Forensic Science Division, investigated it. On these working copies, the original CTL-pulse track from the FLIR videotapes has been recorded into one hi-fi soundtrack to be used for examination of authenticity, and the original sound hi-fi tracks from FLIR videotapes were mixed together and recorded into the second hi-fi sound track. During the preparation process two FLIR videotapes Q-6 and Q-7, gave indications of not being original recordings. One indication is the fact that the video signal contained color synchronization, which is a facility that the FLIR sensor did not support. Secondly, Q-6 and Q-7 did not have hi-fi sound tracks, which should have been present if they were recorded on same type of video recorders that produced Q-1 to Q-5. Thirdly, there is a trace of an earlier head switch that has been added by a playback video machine during the copying process.

As a result of these observations the recorded video signal on FLIR videotape Q-6 and Q-7 was compared to the recorded signal on FLIR videotape Q-1 – Q-5. When Q-6 and Q-7 were produced, the video signal underwent some significant signal processing. First, the synchronization portions have been changed to a signal that contains color synchronization. Secondly, the synchronization part of the video signal recorded on Q-6 and Q-7 does not match the video signal amplitude, of Q-1 – Q-5. Thirdly, an aperture facility has been used. In practice this means that every edge of fast action is amplified and thereby deviates from the original level. This has caused the trailing edge of every action to be enhanced, which can be seen both in the picture and as a measurable signal. Fourth, the copying process has also fed a discernable amplitude variation in the vertical direction. The noise levels have been increased, not only due to an aperture facility, but by virtue of the copying process. Figure 6.12 shows averaged video line information.

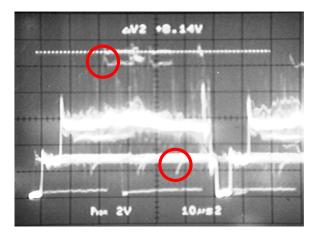


Figure 6.12. An oscilloscope picture viewing averaged line information from tape Q-6. The enhanced edges are clearly observable (red circles).

In short, FLIR videotapes Q-6 and Q-7 were determined to be copies and were instead used to investigate the authenticity of their masters. Consequently, the video signals recorded on FLIR videotapes Q-6 and Q-7 are not to be used for image measurements.

6.4 Analysis and Result

Results from the analysis are summarized in section 7.

6.4.1 Visual Inspection of Playback Picture

The airborne FBI Nightstalker FLIR system initially generated the recorded video signal on FLIR videotapes Q-1 to Q-7. Since the FBI Nightstalker slowly circled above the compound, the recorded subject itself and the slow image motion were a perfect object for visual inspection, as a jump or any fast change in the picture will be clearly observable. Initially, a visual inspection of the playback picture was performed to determine if there were any abnormal changes or jumps in the picture that could indicate some kind of editing or erasure. The results from this visual examination were:

FLIR videotape Q-1. The first frame of the actual sequence starts at 05:58:11, and the actual sequence ends with 08:00:02. However, in the initial part of the videotape, frames with at least three different dates and time information were found, 05:19:00 04/17/93, 03:06:39 04/18/93 and 05:51:43 04/19/93. All three portions have been recorded over by the recorded portion 05:58:11 – 08:00:02. There are no indications of breaks or edited parts on the recorded portion 05:58:11 – 08:00:02.

- FLIR videotape Q-2. There were no indications of breaks or edited parts on the recorded portion 07:57:42 09:28:20.
- FLIR videotape Q-3. There were no indications of breaks or edited parts on the recorded portion 05:58:09 07:57:00.
- FLIR videotape Q-4. The recording of the video sequence was interrupted between 10:47:16 and 10:51:57, according to the time information displayed in picture. There is no sign that this interruption is an edit or erasure. It appears to only be a stop during recording that probably was induced by the operator. There are no other indications of breaks or edited parts, beside this interruption, on the recorded portion 10:41:57 12:16:13.
- FLIR videotape Q-5. There were no indications of breaks or edited parts on the recorded portion 12:16:37 13:39:07.
- FLIR videotape Q-6. In the beginning of the videotape there was a sequence with color bars and the text "30421013E QE". There are no indications of breaks or edited parts on the recorded portion 12:41:25 14:01:38. By comparing the picture and recorded length to videotape Q-5, it is further concluded that the master for this recording is <u>not</u> FLIR videotape Q-5.
- FLIR videotape Q-7. In the beginning of the videotape there was a sequence with color bars and the text "30421013E QE". The recorded video sequence is interrupted between 10:47:15 10:51:57, according to the time information displayed in picture. There is no sign that this interruption is an edit or erasure. It appears to only be a stop during recording that probably was induced by the operator. There are no indications of other breaks or edited parts on the recorded portion 10:41:57 12:41:07. By comparing the picture and recorded length to videotape Q-4, it is concluded that the master for this recording is not FLIR videotape Q-4.

6.4.2 RF-envelope and Carrier Frequency for Recorded Video Signal

The playback RF-envelope on the entire recorded part, for each of the FLIR videotapes, was observed using an oscilloscope. This aim was to determine if there were any changes or level fluctuations that could indicate an attempt to tamper with the recorded material. The lowest frequency of the video signal's RF-carrier has been monitored with an oscilloscope to detect if there were abnormal changes in carrier frequency. Such a change would indicate the use of other recording devices. The lowest stable frequency available for examination occurs during vertical synchronization. By using an oscilloscope to capture several cycles of the RF-carrier it was possible to calculate the frequency, and also to exclude changes that would indicate a different video machine.

The results from this inspection were:

- FLIR videotape Q-1. Only normal variations have been detected. Carrier frequency is about 3.44 MHz.
- FLIR videotape Q-2. Only normal variations have been detected. Carrier frequency is about 3.43 MHz.
- FLIR videotape Q-3. Only normal variations have been detected. Carrier frequency is about 3.43 MHz.
- FLIR videotape Q-4. A fast disturbance in RF-envelope occurs at 10:47:16, according to the time information displayed in picture. Both the RF-envelope and carrier frequency remained similar, before and after the disturbance. The disturbance was identified as a stop during recording. Referring to the time information displayed in the picture there is an interrupt in recording that last between 10:47:16 and 10:51:57. Carrier frequency is about 3.44 MHz.
- FLIR videotape Q-5. Only normal variations have been detected. Carrier frequency is about 3.42 MHz.
- FLIR videotape Q-6. Only normal variations have been detected. Carrier frequency is about 3.31 MHz.
- FLIR videotape Q-7. Only normal variations have been detected. Carrier frequency is about 3.31 MHz.

The results from analyzing the RF-envelope and carrier frequency is that only normal variations in RF-envelope and carrier frequency recorded on FLIR videotapes Q-1-Q-7 were observed through the entire recorded portions of the FLIR videotapes.

The visible break in recording that occurs on FLIR videotape Q-4 from 10:47:16 to 10:51:57 is with a disturbance in the RF-signal. Both the RF-envelope and carrier frequency signals remained similar before and after the disturbance. This indicates that Q-4 was made utilizing the same video machine.

The break in recording that occurs on FLIR videotape Q-7 at 10:47:15 and lasts until 10:51:57 does not have a disturbance in the RF-signal. This indicates that Q-7 is a copy and that the recording was continuous during the copying process.

6.4.3 RF-envelope and Carrier Frequency for FM-audio

Since the recorded sound on videotapes Q-1-Q-5 are FM-type and deeply modulated into the surface of the videotape, it is not possible to edit or erase this track without also tampering with the video

signal. Therefore, this part of the analysis was performed in conjunction with the analysis of the RF-envelope for the video signal. The carrier's average center frequency of both channels has also been measured during playback.

The results from this inspection were;

- FLIR videotape Q-1. Only normal variations of the playback envelope have been detected. Carrier frequency: left channel = 1306.5 kHz, right channel = 1705.3 kHz.
- FLIR videotape Q-2. Only normal variations of the playback envelope have been detected. Carrier frequency: left channel =1305.3 kHz, right channel = 1704.8 kHz.
- FLIR videotape Q-3. Only normal variations of the playback envelope have been detected. Carrier frequency: left channel =1303.5 kHz, right channel = 1703.8 kHz.
- FLIR videotape Q-4. A disturbance in RF-envelopes occurs at 10:47:16. Both the RF-envelopes and carrier frequencies remained similar, before and after the disturbance. The disturbance was identified as a stop during recording. According to the time information displayed in picture the stop lasts between 10:47:16 and 10:51:57. Carrier frequency: left channel =1307.0 kHz, right channel = 1705.5 kHz.
- FLIR videotape Q-5. Only normal variations of the playback envelope have been detected. Carrier frequency: left channel =1306.0 kHz, right channel = 1705.0 kHz.
- FLIR videotape Q-6. No carriers were recorded.
- FLIR videotape Q-7. No carriers were recorded.

The conclusion after analyzing the FLIR videotapes Q 1-Q-5 is that the recorded audio FM - carrier on FLIR videotapes Q-1-Q-5 are original recordings without any erased or edited parts. The visible break in the recording that occurs on FLIR videotape Q-4 at 10:47:16 and lasts until 10:51:57 has a simultaneous disturbance in the RF-signals. Both RF-envelopes and carrier frequencies signals remained similar before and after the disturbance. This indicates that a single video recorder made Q-4.

Videotapes Q-6 and Q-7 were not recorded with deep modulated FM-carriers for hi-fi sound.

6.4.4 Dihedral Error Measurement

It is possible to estimate the dihedral error from the time shift in the video signal that occurs at the head switch position. By measuring the time shift related to the specific recording and the playback video machine a "time shift" signature is produced. Variations in this signature could indicate if more than one

machine has been used for recording a particular tape, or if there have been edits subsequently produced by another machine. For each videotape the time shift has been monitored during the recorded portion. The measurements are from field one, at a midpoint of the recorded portion. The numerical value is for the line period where the head switch occurs. The results from analyzing the dihedral error were;

- FLIR videotape Q-1. In the head switch point, the line period is expanded to 77.7 μs.
- FLIR videotape Q-2. In the head switch point, the line period is expanded to 83.3 μs.
- FLIR videotape Q-3. In the head switch point, the line period is expanded to 83.6 μs.
- FLIR videotape Q-4. A fast disturbance in the video signal occurs at 10:47:16, according to the time information displayed in picture. The disturbance is identified as a break during recording, and according to the time information the break lasts between 10:47:16 and 10:51:57. The dihedral error remained similar throughout the entire recording indicating that a single video recorder made Q-4. In the head switch point, the line period is expanded to 78.6 µs.
- FLIR videotape Q-5. In the head switch point, the line period is expanded to 69.4 μs.
- FLIR videotape Q-6. In the head switch point, the line period is expanded to 70.2 μs. There is also a sign of an additional head switch caused by another playback video machine during the copying process.
- FLIR videotape Q-7. In the head switch point, the line period is expanded to 70.2 μs. There is also a sign of an additional head switch caused by another playback video machine during the copying process.

There were no indications that more than one video machine per FLIR videotapes Q-1-Q-7 should have been used for recording.

6.4.5 CTL-pulses

The CTL-pulses that were recorded on the working copies of FLIR videotapes Q-1-Q-7 were examined. Different manufacturers use different standards for CTL-pulses. In practice, this means that the recorded CTL-pulses will vary between different types of video machines. Variations can also occur between individual video machines. For each of the videotapes the CTL-pulses have been monitored among the recorded portion on the working copies.

The results from analyzing the CTL-pulses were;

- FLIR videotape Q-1. Only normal variations among the recorded portion were detected.
- FLIR videotape Q-2. Only normal variations among the recorded portion were detected.
- FLIR videotape Q-3. Only normal variations among the recorded portion were detected.
- FLIR videotape Q-4. A double CTL-pulse occurs at 10:47:16, according to the time information displayed in picture. By analyzing the CTL-pulses, it can be seen that the recording have been interrupted, and only one frame have been over recorded, i.e. there was no earlier recordings that have been over recorded.
- FLIR videotape Q-5. Only normal variations among the recorded portion were detected.
- FLIR videotape Q-6. Only normal variations among the recorded portion were detected.
- FLIR videotape Q-7. Only normal variations among the recorded portion were detected.

The double CTL-pulse that occurs on FLIR videotape Q-4 does not constitute an edit point created in an edit video machine, since such an edit operation do not affect the flow of CTL-pulses.

The break during recording that appears in images on FLIR videotape Q-7, does not appear on the CTL-track. This is because the video signal was restored during the copy process, and there was no interrupt or variations in the synchronization signal that was fed to the recording video machine.

The recorded CTL-pulses on the FLIR videotape Q-1-Q-5 are similar, which indicates that similar sources have been used for recordings, such as video machines of the same type. The result also shows that recorded CTL-pulses on the FLIR videotape Q-6-Q-7 are similar, which indicates that similar sources have been used for recordings, such as video machines of the same type.

7. RESULTS AND CONCLUSIONS

Section 7.1 summarizes the results from the image analysis part of the investigation, while section 7.2 deals with the results from investigating the authenticity.

7.1 Image Analysis

Several flashes are seen on FLIR videotape Q-4 recorded by the FBI Nightstalker surveillance aircraft on April 19, 1993, between 10:41 a.m. -12:16 p.m. In order to determine the cause of the flashes, a sophisticated computer hard and software systems solution was used to analyze the FLIR imagery, specially designed to maintain the image quality and limit further degradations.

In the case of alleged gunfire in open areas close to the complex, it is reasonable to assume that persons present to fire the subject weapons would be possible to detect on the FLIR imagery. Dr. Allard explained the lack of persons on the FLIR imagery as an inability to resolve the temperature differences, (app. 2, item 53). According to (app.2, item 71), Paul Beaver also concluded gunmen to be hard to detect if wearing Kevlar suits. Differences in radiated temperature from suits can occasionally be seen on the Fort Hood flight trial imagery from March 19, 2000. The Nightstalker imagery is of better spatial resolution and thermal sensitivity than the Lynx FLIR. The Lynx FLIR is very similar in performance to the FLIR used on April 19, 1993.

Moving persons are however possible to detect, at least partially, whenever the contrast relative to the wide temperature range of the background provides. From analyzing sequences from FLIR videotapes Q-1 and Q-5 and the March 19, 2000, Fort Hood flight trial imagery, it was verified that the FBI Nightstalker FLIR could resolve persons. Even if persons on the FLIR images momentarily appeared "thermally invisible," it is highly implausible that a moving person, regardless suit worn, would have the same temperature as all of the complex background, at all times, on the FLIR imagery.

To determine if anything of consequence or if any persons were present in relation to each of the flashes, sequences of the FLIR imagery were enhanced in the area surrounding the flashes. When moving objects were identified proximate to a flash, analytical methods were employed to determine whether the movement was human in form or nature. The detected motion patterns were analyzed by tracing the movements. The moving objects were measured in size and grey levels. If the motion pattern seemed human-like, yet another method to analyze the motion pattern was to be applied. However, no human-like motion was found in the area surrounding the flashes, only moving debris. A further search for activity within low contrast areas in the FLIR imagery was performed, but without any findings that can be concluded to be persons. Neither have any persons been detected on the reviewed duplicate photos and copies of videotapes that were exposed close in time to the flashes.

From these results it is concluded with a reasonable level of certainty that all detected moving

objects are debris. The appearance of persons between 10:41 a.m. -12:16 p.m. on April 19, 1993, cannot be entirely excluded from analyzing FLIR videotape Q-4, the duplicate photos and videotapes, due to the limitations in resolution, field of view and presence of image artifacts as these are factors contributing to the low quality of the imagery. No human type movement or activity was however detected proximate to any of the flashes on the April 19, 1993, FLIR videotape Q-4. In fact nothing of consequence was detected proximate to any of the flashes.

During one of the first visual review of the FLIR videotapes, it was discovered that several of the flashes appeared at fixed positions and on a regular basis that agreed with the FBI Nightstalker's circular movements over the Branch Davidian complex. This result strongly suggested that the majority of the flashes were caused by solar reflections. To confirm these findings the reflection geometry was reconstructed utilizing a 3D model based on the physical laws of reflections. The 3D model incorporated the positions of the Branch Davidian complex, the sun and the FBI Nightstalker.

Based upon the striking correlation of the theoretical model and physical laws of reflections in comparison to the reconstructed geometry, it is concluded with a confident level of certainty that solar specular reflections on the FLIR videotapes are not only possible but have caused the majority of flashes on the April 19, 1993, FLIR videotapes. These findings were further confirmed by an additional experiment, which confirmed that solar reflections could, in fact, be captured by the FLIR sensor. The experiment also confirmed the model used to reconstruct the geometry of the flashes. It is also concluded with a reasonable level of certainty that some flashes were caused by heat reflections.

Four flashes of a pulsating nature could not be explained to reflections solely from the reconstructed data. The core of the FBI Nightstalker FLIR, the infrared SPRITE/TED detector elements and scanning mechanisms were believed to have contributed in causing undesired image artifacts on the FLIR videotapes. The interlaced video format used for recording the FLIR imagery were also believed to have contributed in distorting small objects like the flashes on the FLIR videotapes. The results from studying the characteristics of FBI Nightstalker FLIR detectors and the interlaced video format, confirmed that small flashes of short duration cannot be assumed to be correctly represented on the FLIR videotapes.

The Fort Hood flight trials were analyzed, as well, and pulsating flashes from reflecting debris were detected on the videotapes from the March 19, 2000, imagery. These pulsating specular solar reflections are distinctly similar to the flashes on the FLIR videotape from April 19, 1993. The muzzle blast flashes seen on the Fort Hood flight trial imagery from March 19, 2000 were different in appearance compared to the flashes on the FLIR videotape from April 19, 1993.

Many contradictory opinions exist on the cause of the flashes seen on the FLIR videotape from April 19, 1993. Due to the contradictory conclusions by experts concerning the cause of the flashes, these reports and statements were carefully reviewed. Dr. Allard and Mr. Maurice Cox, among others, conclude that the flashes are gunfire. Dr. Allard and Mr. Cox's gunfire hypothesis is not only based on wrongful assumptions, but also suffers from neglecting several important scientific parameters.

The Maryland Advanced Development Laboratory concluded that gunfire could be eliminated based solely on duration in all but 4 of the 90 events they analyzed, (app. 2, item 58). Their conclusion was based on an extensive analysis on muzzle blasts in the far IR, (app. 2, item 59) and (app. 2, item 60-61). From a contextual analysis and the strong correlation to other flashes from the same position, they judged these 4 events to be caused by other phenomena than small arm fire and strongly suggested specular solar reflections. Moreover, Duane Burchick, Maryland Advanced Development Laboratory, proved solar specular reflections on a watery surface at 10:53:25 on the FLIR videotape Q-4, (app. 2, item 62). Burchick also confirmed the potential of solar specular reflections in the far IR from a video recording, (app. 2, item 15).

Dr. Allard and Mr. Cox contend that the FBI Nightstalker FLIR could <u>not</u> record solar reflections. In the visual band sun glints are well known phenomena. Normally, sun glints does not cause too much of a problem in thermal images in the far IR band, $7-13~\mu m$. In the mid IR $3-5~\mu m$ sun glints are more likely to add to the complexity of image interpretation. The appearances of sun glints in the far IR band are, however, well documented in the literature. Two examples are [HolstIR] and [Cuthbertson]. The large amount of glass from broken windows and the large amount of reflective debris from the demolished complex are factors that have contributed to a significant increased possibility of specular solar reflections then would have been the case at an earlier stage of the siege. Vector Data Systems (U.K.) Ltd. conducted a thorough review of the FLIR videotapes and the corresponding collateral imagery from which they accurately identified several of the reflecting objects, (app. 2, item 65). The appearance of sun glints on the FLIR imagery during the Fort Hood flight trials further verified that reflections are possible.

Contributing to Mr. Cox misinterpretations is his wrongful assumptions regarding the Nightstalker's speed and its position relative to the Branch Davidian complex. Variations in the flight path are compensated for by the on board operator in order to obtain imagery of the complex. Mr. Cox also disregards the effects of the wind that substantially affected the flight path. The wind caused the FBI Nightstalker's ground speed to vary significantly and thereby the duration time of the solar specular reflections. Therefore, constant airspeed cannot be used as in Mr. Cox calculations. Moreover, the surfaces of reflective objects can not be assumed to be aligned with the ground plane, but his assumption regarding reflections to be arbitrarily directed is correct. However, neither of these two reflection models makes any sense after the wrongful assumption about misplacement of aircraft's position.

Therefore, misplacements in the aircraft's circular movements from an ideal and constant flight path cannot be used in the reflection geometry model to prove that solar specular reflections are impossible. Misplacements from an ideal circular flight path would have been a more correct assumption if the FLIR sensor was instead fixed to the aircraft and directed by the fuselage. From the reconstructed flight paths in this investigation, section 5.4, it was seen that such precision can not be assumed. In practice, under the conditions on April 19, 1993, it is extremely difficult to keep the aircraft on track with such precision needed to keep the Branch Davidian complex in a fixed FLIR sensor field of view. This is mainly due to FBI Nightstalker FLIR system's narrow field of view, the distance to the complex and the

strong wind.

Dr. Allard stated "nothing in nature could do this" regarding the pulsating nature of thermal signatures. Multiple reflective objects and the characteristics of the FLIR imaging systems have within this work been concluded, with a reasonable level of confidence, to have created pulsating flashes. Neglecting the FLIR sensor scanning mechanisms and the interlaced format of used video standard, are factors contributing to Dr. Allard's and Mr. Cox's misinterpretation of the flashes seen on the FLIR videotapes from April 19, 1993.

The presence of solar specular reflections has been very well confirmed. The Maryland Advanced Development Laboratory conclusions gives a much more accurate and correct explanation of the flashes seen on the April 19, 1993, FLIR imagery. Dr. Allard's and Mr. Cox's conclusion that the FBI Nightstalker FLIR cannot record solar reflections has been proven wrong. In short, the reviewed reports and declarations confirm that solar reflections are the major source of the flashes seen on the FLIR videotapes from April 19, 1993.

The results from investigating the start and spread of the fire have been provided to Ulf Wickstöm, SP, Swedish National Testing and Research Institute, Borås, Sweden and were used in his Report to the Office of Special Counsel.

7.2 Video Authentication

The following electrical signatures have been analyzed; RF-envelope for video signal, RF-signal carrier frequency for video signal, RF-envelope for FM-audio signal, RF-signal carrier frequency for FM-audio signal, dihedral error measurements and CTL-pulses.

FLIR videotape Q-1 has at least three previous recordings found in the beginning of the tape, which all three have been over-recorded. The recording made at 05:58:11-08:00:02 on April 19, 1993, is an original recording with no signs of edit or erasure to the recorded portions.

FLIR videotape Q-2 is an original recording with no signs of edit or erasure to the recorded portions.

FLIR videotape Q-3 is an original recording with no signs of edit or erasure to the recorded portions.

FLIR videotape Q-4 is an original recording with no signs of edit or erasure to the recorded portions. Although the recording is interrupted between 10:47:16 – 10:51:57 there is no sign that this portion of the tape was edited or erased.

FLIR videotape Q-5 is an original recording with no signs of edit or erasure to the recorded portions.

FLIR videotape Q-6 is a first generation copy from an original master. There is no sign that the FLIR imagery has been edited. The master for this recording is not FLIR videotape Q-1-Q-5.

FLIR videotape Q-7 is a first generation copy from an original master. Although the video sequence is interrupted between 10:47:15 and 10:51:57 there is no sign that this interruption in recording is an edit point. There is no sign that any other part of the FLIR imagery has been edited or erased. The master for this recording is not FLIR videotapes Q-1-Q-5.

7.3 Conclusions

Finally, it is concluded with a confident level of certainty that all of the analyzed flashes seen on FLIR videotapes from the April 19, 1993, between 10:41 a.m. - 12:16 p.m. are caused by solar or heat reflections from single or multiple objects. The characteristics of the SPRITE/TED detectors and scanning mechanisms and the interlaced video format are factors that have contributed to distort the appearance of the flashes on the April 19, 1993, FLIR videotapes. Moreover, no humans were detected on the FLIR videotapes in any area in the vicinity of any of the flashes. Only moving debris were detected. The results from this investigation have shown, with a confident level of certainty, that the flashes on the FLIR videotapes from the April 19, 1993, between 10:41 a.m. - 12:16 p.m. cannot form evidence of gunfire.

It is also concluded, with a confident level of certainty, that FLIR videotapes Q-1 – Q-5, are original recordings. There is no sign that the recorded portions on FLIR videotapes Q-1 – Q-5 have been edited or erased after they were produced. It is concluded, with a confident level of certainty that the interrupt on FLIR videotape Q-4, between 10:47:16 and 10:51:57, was not created afterwards but during the time of recording. It is also concluded, with a confident level of certainty, that FLIR videotapes Q-6 – Q-7 are copies.

October 4, 2000

Mrs. Lena KLASÉN Orlunda Agro & IT Skänninge, SWEDEN

Mr. Sten MADSEN Aservice i Linköping Linköping, SWEDEN

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APPENDIX 1. AUTHOR BIOGRAPHIES

Mrs. Lena M. WIDIN KLASÉN.



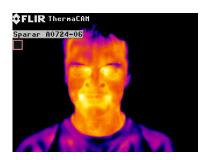
Mrs. Klasén has worked for the Swedish government since 1988, both for the Swedish Defence and the Swedish National Police. After receiving her MSc in Computer Science and Technology at University of Linköping in 1988, Mrs Klasén worked 1988-1995 as a flight test engineer at the Testing Directorate, Defence Material Administration in Malmslätt, Sweden. Testing airborne reconnaissance, registration and surveillance systems, she come to work with CCD-, IR- as well as CMOS sensors, video of varying TV- and video format, digital and digitized video as well

as still images. One of the tasks was to analyze image sequences using image analysis systems and software specialized for the purpose. She has also operated as an onboard engineer during flight tests. During one year from August 1994, she was stationed at Saab Military Aircraft to assist in image analysis within the Swedish fighter aircraft JAS39 Gripen test program. She has also been stationed at several Swedish Airforce air wings for shorter periods. In 1995 she received a new position as a systems engineer and worked with integration of the JAS39 avionics systems, which included the reconnaissance, sensing and recording systems among others.

Since January 1996, until August 2000 she was employed by the National Laboratory of Forensic Science, SKL, Sweden where she worked as a forensic engineer and also joined the Image Coding Group at Department of Electrical Engineering University of Linköping as a Ph.D. student. At SKL she established the image lab and several of the analytical methods in operative use. From May 1998 until September last year, she was head of the Information Technology group. The group dealt with casework in the area computer evidence, audio processing, and photography as well as image analysis. Since January this year she has devoted her full attention on her Ph.D. project on "3D reconstruction of shape and motion of non-rigid objects", or in common language "tracking and measuring persons from video". Since 1995 she have been investigating about two hundred cases, either in charge or as co-operating investigator. Measurement from images, identification from facial images, authentication of video and still images, technical investigations of video, imaging- or recording devices were some of the analytical methods she was involved in. She has also published book chapters and conference papers, on her research topic as well as on image analysis for forensic applications.

In January 2000 she established a small company to work on this investigation on a part time basis. Since September 1, 2000, she works as a researcher at the Defence Research Establishment, Division of Sensor Technology.

Mr. Sten K. MADSEN



Since 1977 Mr. Madsen has run his own company Aservice i Linköping, mainly in the field of video support, products and consultations. His company supports productions companies and industries using video equipment for documentation and research. Mr. Madsen has a many years of experience from service and alignment of different videotape formats and auxiliary equipment such as video mixers, time base correctors, textgenerators and digital video effect generators. Mr. Madsen has also been involved on several occasions, in specifying and constructing video-

recording studios. He has also participated in numerous short training courses and workshops arranged by manufacturers. This experience has lead to a vast knowledge of videotape format such as VHS, SVHS, V8, Hi8, U-matic, highband/SP U-matic, Betacam, Betacam SP and also digital video (DV) format. One of Mr Madsen's special skills is to modify system components to suit special purpose applications, such as systems for airborne or underwater applications, to meet the customer's requirements.

Between February 1996 and December 1999 Mr. Madsen worked as a forensic engineer at the National Laboratory of Forensic Science in Sweden. In this job, Mr Madsen investigated cases concerning technical investigations of video. Some examples are tracing imaging or recording devices, video authenticity, copying order and editing.

Among his customers are Saab Military Aircraft, Saab Dynamics, Swedish National Police, Defence Research Establishment, Defence Material Administration, Swedish Army, Swedish Airforce and Bofors Underwater Technology.

APPENDIX 2: SOURCE OF DATA

Videotapes

1.	Videotape Q-1, VHS
	"Nightstalker - 4/19/93 Tape#1 -5:57 Am-8:00 Am Q-1"
2.	Videotape Q-2, VHS
	"Nightstalker - 4/19/93 Tape #2 7:57A-9:30 AM Q-2"
3.	Videotape Q-3, VHS
	"Q-3 Nightstalker 4/19/93 Tape #1 -5:57AM-7:57AM"
4.	Videotape Q-4, VHS
	"Tape 1 ORIGINAL 4/19/93 appx 1:30 Q-4"
5.	Videotape Q-5, VHS
	"4/19/93 Tape II Waco ORIGINAL appx 45 min Q-5"
6.	Videotape Q-6, VHS
	"Tape #16 FBI aerial infra-red recording of Mt. Carmel's Branch Davidian Compound
	on 4/19/93, 12:41 p.m. through 2:01 p.m. (2 of 2). Elsur #1B-319"
7.	Videotape Q-7, VHS
	"Tape #15 FBI aerial infra-red recording of Mt. Carmel's Branch Davidian Compound
	on 4/19/93, 10:41 a.m. through 12:41 p.m. (1 of 2). Elsur #1B-319"

Copies of Videotapes

8.	Videotape, BASF VHS
	U. S. Postal Inspection Service, "Direct copy Qc1., Lab date 12/21/99".
9.	Videotape, BASF VHS
	U. S. Postal Inspection Service, "Direct copy Qc2., Lab date 12/21/99".
10.	Videotape, BASF VHS
	U. S. Postal Inspection Service, "Direct copy Qc3., Lab date 12/21/99".
11.	Videotape, BASF VHS
	U. S. Postal Inspection Service, "Direct copy Qc4., Lab date 12/21/99".
12.	Videotape Maxell VHS, Reference video from FLIR
	"FLIR from March 26, 1993. Copied for Lena Klassen"
13.	Videotape "Waco Gunfire footage", Maxell VHS
14.	Videotape "Major Network News", Maxell VHS
15.	Videotape, VHS

	"Maryland Advanced Development Laboratory Solar Specular Reflections in the far IR
	spectrum • VDS •"
16.	Videotape NS-1, VHS
	"NS-1 Direct copy 3/29/00", copy of video recording during Fort Hood flight trials,
	Night Stalker.
17.	Videotape Lynx-1, VHS
	"Lynx 1 Direct copy 3/29/00", copy of video recording during Fort Hood flight trials,
	Lynx.
18.	Videotape Lynx-2, VHS
	"Lynx 2 Direct copy 3/29/00", copy video recording during Fort Hood flight trials,
	Lynx.
19.	Videotape, VHS, ThermaCAM video from Forth Hood flight trials
	"U. S. Postal Inspection Service, Direct copy FLIR videotape #1, 3/19/00"
20.	Videotape, VHS, ThermaCAM video from Forth Hood flight trials
	"U. S. Postal Inspection Service, Direct copy FLIR videotape #2, 3/19/00"
21.	Videotape, VHS
	"U. S. Postal Inspection Service, Direct copy V-3 #1, 3/19/00"
22.	Videotape, VHS
	"U. S. Postal Inspection Service, Direct copy V-3 #2, 3/19/00"
23.	Videotape, VHS
	"U. S. Postal Inspection Service, Direct copy Camera 1 Tape 1 of 2, 3/19/00"
24.	Videotape, VHS
	"U. S. Postal Inspection Service, Direct copy Camera 1 Tape 2 of 2, 3/19/00"
25.	Videotape, VHS
	"U. S. Postal Inspection Service, Direct copy Camera 2 Tape 1, 3/19/00"
26.	Videotape, VHS
	"U. S. Postal Inspection Service, Direct copy Camera 2 Tape 2, 3/19/00"

Digital Images

27.	DVD CLONE, Copy of a DVD, "FLIR footage" from April 19, 1993, Forensic Video
	Inc., Minneapolis.
28.	TDK CD, "Photographs from FBI of Davidian Compound 4/19/93".
29.	SONY CD-R. Copy of CD containing "Photographs from FBI of Davidian Compound
	4/19/93".
30.	CD-RW IMATION
	"Folder FBI 4-19-93; 77 files"
31.	Kodak DS Photo CD
	"Scanned photos"

32.	Kodak DS Photo CD
	"Scanned photos"
33.	Zip-diskette
	"Fire Pixs, 39 files" FBI1210067, WACMUR Roll 2608
34.	Zip-diskette
	"Tactical Pixs, 46 files" FBI1210067, WACMUR Roll C 040943
35.	Hard drive containing results of 2000 FLIR trials
36.	CD Maxell, ThermaCAM primary digital images from ground position during Fort Hood
	flight trials and related software

Photos and Duplicate Photos

37.	Four photos from Fort Hood flight trials, aerial view
	United States Postal Inspection Service, roll #1 A00031087
38.	Four photos from Fort Hood flight trials, aerial view
	United States Postal Inspection Service, roll #2 A00031087
39.	Twenty-four photos from Fort Hood flight trials, aerial view
	United States Postal Inspection Service, roll #3 A00144476
40.	Twenty photos from Fort Hood flight trials, debris
	United States Postal Inspection Service, roll #4 A00144477
41.	Twenty-four photos from Fort Hood flight trials, debris
	United States Postal Inspection Service, roll #5 A00144477
42.	Three copies of photos taken from a black side sniper position showing the demolished
	catwalk roof
43.	Five pages duplicate images taken from a black side sniper position showing the
	demolished catwalk roof and the fire at the cafeteria

Maps and Drawings

44.	OSC Group I, Packet A: Mt. Carmel Floor Plan, Floors 1-4
45.	OSC Group I, Packet B: Branch Davidian Cause of Death Color Coding Grid/Bunker
	Recovery Grid
46.	OSC Group I, Packet C: Mt. Carmel Side Views
47.	OSC Group I, Packet D: Mt. Carmel First and Second Floor Plans
48.	OSC Group I, Packet E: Maps and Diagrams of Mt. Carmel and Surrounding Area
49.	OSC Group I, Packet F: Mt. Carmel Side Views

50.	Stake positions of Mount Carmel Compound generated by the FBI 6 days after the siege
	ended and a drawing of first floor plane revised 4/22/93.
51.	A 3D model of the complex, <i><mount carmel.dfx=""></mount></i> .
52.	Six drawings of the complex external and interior views.

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IMAGERY ANALYSIS REPORT

THE EVENTS AT WACO TEXAS 19 APRIL 1993

PREPARED FOR

THE US DISTRICT COURT FOR THE WESTERN DISTRICT OF TEXAS

AND

THE OFFICE OF SPECIAL COUNSEL

BY



IMAGERY ANALYSIS REPORT THE EVENTS AT WACO TEXAS 19 APRIL 1993

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ATTACHMENT 1: RESUMES OF NICK M. EVANS, PETER AYRES AND DANIEL DAVID OXLEE

ATTACHMENT 2: IMAGERY ANALYSIS REPORT FLIR TRIAL

ATTACHMENT 3: Log of Documents Received

ATTACHMENT 4: MENSURATION REPORT FOR THE ANALYSIS OF MOUNT CARMEL COMPOUND

ATTACHMENT 5: IMAGERY INTERPRETABILITY RATING SCALES (IIRS)

1 EXECUTIVE SUMMARY

1.1 Background

On 9 September 1999, the Attorney General of the United States of America appointed Senator John C. Danforth to investigate certain events that occurred at the Mt. Carmel Compound in Waco, Texas on 19 April 1993. Immediately after his appointment, Senator Danforth established the Office of Special Counsel (OSC) to carry out this investigation.

On 2 Dec 99, VDS (UK) was engaged by the OSC and the US District Court for the Western District of Texas to review FLIR imagery taken by an FBI Night Stalker aircraft flying over the Mount Carmel compound on 19 April 1993.

VDS (UK) was tasked to determine:

- Whether Government forces fired weapons
- Whether the start time of the fire could be identified on the FLIR
- Whether personnel could be seen on the ground

To address these points VDS (UK) has:

- Examined all FLIR tapes from the FBI Night Stalker
- Examined hand-held air-to-ground imagery taken by the FBI relevant to the task
- Examined hand-held ground imagery relevant to the task
- Taken into account the results of the FLIR trial staged by VDS (UK) at Fort Hood in March 2000

VDS (UK) received a report¹, originated by the Davidian experts' study of the FLIR imagery, alleging:

- 15 instances of Government gunfire
- 3 Flashbang detonations
- 1 sighting of a person on the ground
- 18 instances of Davidian gunfire

In addition to these 37 reported instances, VDS (UK) then identified a further 20 instances of similar anomalous thermal activity.

Our following report provides an analysis of these 57 events.

Detailed exploitation of the FLIR imagery, together with comparative analysis of the collateral imagery, and of muzzle flash and debris reflection identified during the FLIR trial, leads us to the following conclusions.

-

¹ Caddell & Chapman – Indications of Gunfire or Heat Flashes on FLIR Tape 3 - 20 Oct 99 supplemented by Edward Allard – Analysis of the April 19, 1993 WACO FLIR Videotapes, March 1, 2000.

1.2 Gunfire

From the information available to VDS (UK), we have concluded that the 57 thermal events, including the alleged sighting of a person, are all caused by Passive Specular Solar Reflection, Active Thermal Reflection or movement of debris.

Our report provides illustrations identifying the causes of these thermal events.

1.3 Time Of The Fire

Our determination of the first outbreak of fire **indicated on the FLIR imagery** is at 12:07:43 on the second floor of the Red/White corner. A near-simultaneous outbreak occurs at 12:08:26 at the cafeteria / kitchen entrance.

Our report provides illustrations of the outbreaks of fire.

1.4 Personnel

Our conclusion is that throughout the morning of 19 April 1993, no persons are seen on imagery until 12:10:50; thereafter numerous personnel (assumed to be Government personnel by their actions) attend the fire.

2 BACKGROUND

2.1 Report Compilation

This report was compiled by staff of Vector Data Systems (UK) Ltd (VDS(UK)).

VDS (UK) is a UK-registered, majority-owned subsidiary of Vector Data Systems Inc (VDS Inc) and is located in Peterborough, England from where it operates primarily in support of UK Ministry of Defence requirements.

The company specialises in providing imagery exploitation ground stations, imagery software and imagery training and consultancy services. The operational and executive control of all VDS (UK) activities is vested in the UK staff, all of whom are UK nationals. VDS (UK) has not previously been under a direct contract to the US government. In 1997 VDS Inc, Alexandria, VA, was acquired by the Anteon Corporation.

The lead VDS (UK) analyst for this report was Daniel David Oxlee, supported by Nick Evans and Peter Ayres. Biographies for these members of staff are at Attachment 1.

2.2 Synopsis

On 9th September 1999, the Attorney General of the United States appointed Senator John C. Danforth to investigate certain events that occurred at the Mount Carmel compound in Waco, Texas on 19th April 1993. Immediately after his appointment Senator Danforth established the OSC to carry out this investigation.

2.3 Instructions

On 2nd December 1999, VDS (UK) was retained by the OSC to analyse and interpret airborne Forward Looking Infrared (FLIR) imaged by the FBI using a Night Stalker aircraft flying an orbit above the Mount Carmel compound on 19 April 1993.

2.4 Disclosure of interests

No member of staff at VDS (UK) has any connection with any of the parties, witnesses or advisers involved in this case.

2.5 The Examination Of Evidence

The examination of imagery evidence took place at VDS (UK) premises at Newark Road, Peterborough, England from 4 January 2000 until 5 May 2000.

2.6 Detailed Methodology

We viewed the FLIR videos using a video recorder with a frame-by-frame viewing capability. This procedure allowed us to observe individual frames at length and to familiarise ourselves fully with the events that took place. We also digitised the FLIR tapes to enable us to use a variety of digital techniques to view, analyse and compare data using the software tools detailed at Para 2.7.

We selected the most appropriate FLIR images of each event in order to determine significant features regarding the Shape, Size, Shadow and Associated Features of the object and its background. Most importantly, we studied the Tonal Ranges of both object and background in terms of ground resolution and thermal discrimination.

Having identified 57 specific instances of potential thermal activity requiring detailed examination, we then undertook a comparative assessment (one event with another) where those events looked similar with regard to sun angle/sensor aspect.

It is important to note that we used all of the available FLIR imagery in making this comparison and not only the frames that have been selected for illustrations in this report.

We then reviewed all the available collateral imagery (ground & air) and conducted comparative analysis with the FLIR, using a variety of softcopy exploitation techniques, in order to reach an interim assessment. Where possible, we used imagery of similar scale and viewpoint.

Finally, and following the FLIR Trial held under our direction at Fort Hood on 19th March 2000 (Attachment 2), we compared results from that FLIR trial with our interim assessment to reach the final conclusions stated in this report.

2.7 Technical Equipment

The imagery was exploited on our Desktop Imagery Exploitation Workstation (DIEWS) which includes the following commercially available software packages:

- Falcon ViewTM
- Digital Imagery Exploitation Production SystemTM (DIEPS)
- Remote ViewTM
- RaindropTM
- Adobe PhotoshopTM
- Adobe PremiereTM

Additionally, we utilised a SUN Ultra 2 workstation mounting DIEPSTM software and CrystalEyesTM stereo viewing equipment to view individual frames in stereo, together with an Apple Mac workstation with MiniCAD 7TM software to generate 3D drawings and support our mensuration.

Report generation and desktop publishing was achieved using a suite of PCs using MicrosoftTM, Paintshop ProTM and AdobeTM software.

The accompanying interactive CD-ROM supporting illustrations were generated using General Dynamics Digital Video Analyser.

2.7.1 To View The Enclosed CD-ROM Interactive Video Clips

- You will need a PC equipped with CD-ROM drive and web browser / media player
- Insert the CD into your CD player
- Select *Run* from your *Start* menu
- Double click the VDS (UK) Report folder to open the folder
- Double click the *Index* icon to open the Index
- When the Analysis Package Index opens, click <u>VDS</u>
- When the Video Package window opens, click <u>VDS</u>
- To play the video clips, click <u>Play Video Clip</u> as required
- To view any attached images click **Attached Files** as required

2.7.2 To View Each Video Clip As A Continuous Loop

• Your *Media Player* may be configurable for *Auto Repeat / Continuous Play*

2.7.3 To View Each Video Clip Frame By Frame

• Your *Media Player* may be configurable for frame by frame play

2.8 Reference Material

All material used in the compilation of this report is itemised at Attachment 3. The information cut-off date was 10 April 2000.

3 THE MT. CARMEL COMPOUND

Figure 1 illustrates the compound and is colour coded in accordance with the reporting colour codes allocated in 1993 by the FBI. For ease of reference we have used these FBI colour codes to avoid confusion and for ease of cross-reference with reporting by other agencies.



Figure 1

Side elevations of the compound are illustrated at Figure 2. Detailed dimensions may be found in our photogrammetry report at Attachment 4.

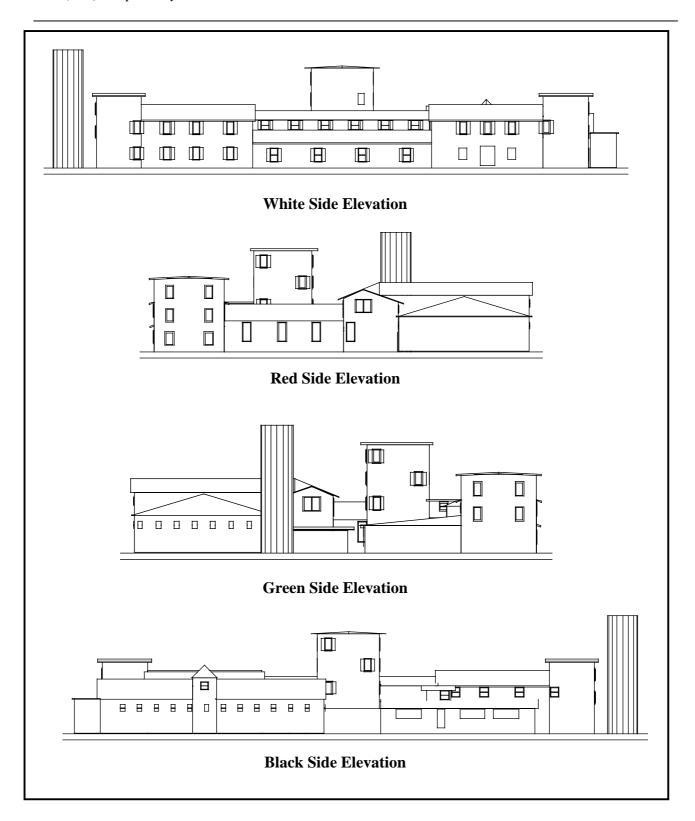


Figure 2

4 FLIR IMAGERY INTERPRETABILITY

Four Night Stalker FLIR tapes covering the events at Mt Carmel on 19th April 1999 were viewed and assessed for interpretative quality using the Infrared Imagery Interpretation Rating Scale (IIRS), adopted as a standard by NATO, and included as Attachment 5.

FLIR TAPE	START	END	IIRS RATING	COMMENT
1	05:58	08:00	0 - 1	-
2	07:57	09:30	2	Night Stalker off task
				09:30 to 10:41.
3	10:41	12:41	6 - 7	Sensor switched off
				10:47:16 to 10:52:58.
				Reason unknown.
4	12:41	14:01	5	Degraded by fire causing
				FLIR system saturation.

4.1 FLIR Tape 1

FLIR Tape 1 covered the acknowledged timespan when Government agents first attempted to displace Davidian personnel present within the compound. Although the tape was viewed throughout, obscuring cloud cover during virtually the whole of this imaging period reduced the overall IIRS rating of FLIR Tape 1 to IIRS 0-1.

The FLIR operator had selected "black-hot" for most of the tape.

An example of the best imagery from FLIR Tape 1 is at Figure 3.

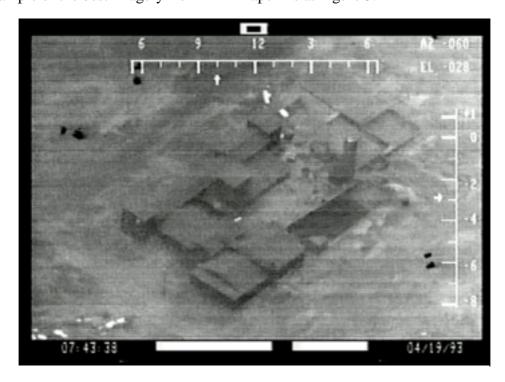


Figure 3

4.2 FLIR Tape 2

FLIR Tape 2 is rated overall at IIRS 2, and again the operator had selected "black-hot".

This imagery was better than on FLIR Tape 1, due to improving weather conditions. Even so, the imagery lacked the potential to observe gunfire, although some military-type vehicle movement was visible. An example is the building penetration on the White side by CEV-1 that occurred at 09.11 hrs, depicted at Figure 4.



Figure 4

4.3 FLIR Tape 3

FLIR Tape 3 is rated at IIRS 6-7, notwithstanding the prolonged time interval since April 1993 and the numerous viewing of this analogue tape by the various parties prior to its despatch to VDS (UK) in January 2000.

FLIR Tape 3 is of an overall resolution sufficient to allow detailed analysis of some 15 instances of alleged² Government gunfire, 3 alleged Flashbang detonations, 1 sighting of a person on the ground together with 18 instances of alleged Davidian gunfire.

² Caddell & Chapman – Indications of Gunfire or Heat Flashes on FLIR Tape 3 - 20 Oct 99 supplemented by Edward Allard – Analysis of the April 19, 1993 WACO FLIR Videotapes, March 1, 2000.

In addition to these 37 reported instances, VDS (UK) has identified a further 20 instances of similar anomalous thermal activity.

4.4 FLIR Tape 4

This "white-hot" tape shows the Compound as the fires rapidly spread. As a consequence, the radiant energy threshold is such that the automatic gain control could not (apparently) produce a meaningful image for much of the time.

5 TERMINOLOGY

Some terminology used in this report is, of necessity, specialist in nature and subject to national variation

However, in this report the term **Passive** refers to a return on the FLIR imagery that is the result of *solar action*, whilst the term **Active** indicates that the source of the emission stems from *mankind* (for example a running engine).

Although **Temperature** is the dominant factor in determining the strength of a thermal return on FLIR, other factors such as the of type of **Material**, the **Surface Texture**, the **Slant Range** from a target, and the **Imaging Aspect** must be considered during detailed imagery analysis.

The majority of commonplace materials have the property to absorb and to subsequently reemit radiant energy to varying degrees in the long-wave infrared part of the electromagnetic spectrum; however, items such as glass and polished metals tend to act very poorly in this respect and display low **Emissivity** with consequent high **Reflectivity**.

In the **passive** sense some glass / polished metals have the ability to reflect more than one-third of the thermal energy incident upon them. Thus, with the right imaging aspect a considerable amount of energy can be reflected back to the sensor system, if the sensor system is moving relative to the Sun angle. The **passive** effect is here termed **Passive Specular Solar Reflection (PSSR).**

In the **active** sense, the same materials can reflect mankind-derived energy to the sensor system, again given the right imaging aspect. The **active** effect is here termed **Active Thermal Reflection (ATR)**.

There is a correlation between the location of the sensor, the sun angle and the recording of PSSR returns on the FLIR. As the aircraft orbits the Mt Carmel compound, certain PSSRs are imaged only when the sensor viewing aspect, sun and reflecting debris are in a specific correlation – we term this sensor viewing aspect the **Sensor Zone of Regard**.

6 PASSIVE SPECULAR SOLAR REFLECTIONS (PSSR)

6.1 FLIR Trial Results

The FLIR trial results (Attachment 2) clearly identify PSSRs collected by the Lynx FLIR in the 8-14 micron part of the electromagnetic spectrum. The following two events, recorded by the Night Stalker FLIR on 19 April 93, act as an empirical example of PSSR, as described in the FLIR Trial report.

6.2 PSSRs At The Swimming Pool

Master Event List VDS Serial 1.

A number of flashes can be observed on the water at the deep end of the pool. The swimming pool flashes are the result of wave motion on the water in reflective line-of-sight with both the sun and the FLIR sensor, and are identified as PSSRs.

There is a very bright return from an unidentified object at the edge of the pool that is assessed also to be a PSSR.

These flashes were not included within the Davidian allegations of weapon discharge, and yet they display very similar characteristics to the other series of flashes claimed to be gunfire, see Figure 5.

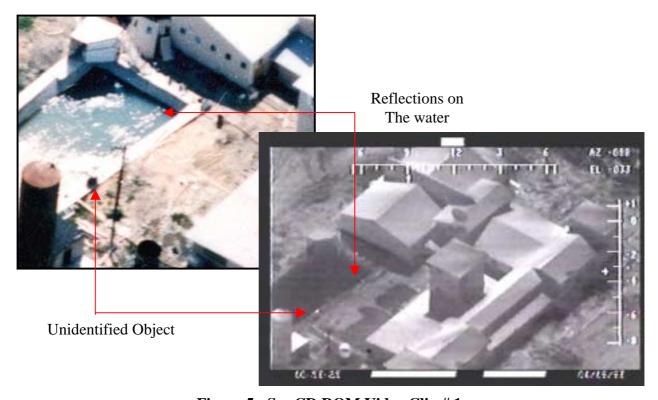


Figure 5 - See CD ROM Video Clip # 1

6.3 PSSRs At The Storage Tank

Master Event List VDS Serial 3.

Two flashes can be seen on the FLIR (Figure 6) that are similar in all respects to the majority of those alleged to be gunfire elsewhere on FLIR Tape 3. These two flashes from the same spot result from what is believed to be a smooth metal plate (Figure 7, imaged prior to 19th April 1993) lying on the ground in reflective line-of-sight with both the sun and the FLIR sensor, and are therefore identified as PSSRs.



Figure 6 - See CD ROM Video Clip # 2



Figure 7

These flashes are not observed at other times since the sun shadow, angularity, and the gap between nearby building and the storage tank are not replicated exactly elsewhere on the FLIR

coverage.

These flashes were not included within the Davidian allegations of weapon discharge, and yet they display very similar characteristics to the other series of flashes claimed by the Davidians to be gunfire.

7 ACTIVE THERMAL RESPONSES (ATR)

7.1 FLIR Trial Results

The FLIR trial results (Attachment 2) clearly identify ATRs collected by the Night Stalker FLIR in the 8-14 micron part of the electromagnetic spectrum. Figure 8, recorded by the Night Stalker FLIR during the 19 Mar 00 FLIR Trial illustrates an empirical example of ATR, as described in the FLIR Trial report.



Figure 8 - See CD ROM Video Clip #3

7.2 ATR Example From 19 Apr 93

Figure 9 illustrates an ATR caused by the heat of the CEV engine reflected from debris on the ground during CEV operations at Mt Carmel.



Figure 9 - See CD ROM Video Clip #4

MASTER EVENT LIST AND VDS (UK) ANALYSIS

VDS (UK) Serial	Time	Event	Alleged Gunfire VDS (UK) Analysis and Flash Durations (seconds)	Report Figure Number
1	10: 53: 24 to 10: 53: 25	Black SideFlashes in water at deep end of pool	PSSRs from water	5
2	10: 54: 21	Red sideFlash at damaged structure (below window B2)	PSSRs from debris amongst damage (³ 0.13, 0.20)	17, 52
3		Green / White sideFlashes near a dome- roofed water storage tank	PSSRs from very low emmisivity material on the ground (1.00, 0.87)	6, 7
4	11: 14: 10	Red side Flash at damaged structure (below window B2)	PSSRs from debris (0.03,0.07,0.03)	18
5	11: 18: 21 to 11: 18: 23	Black side Flash from left rear hull of CEV- 2	⁴ Alleged Government Gunfire PSSRs from debris on CEV (0.90)	37
6	11: 18: 48	Black sideFlash at demolished corner of Gym	Side panelling pushed out by CEV- 2. Top edge movement of resultant debris depicted (0.53)	38
7	11: 23:25	Black sideFlash near left rear of CEV- 2, close to Gym	Alleged Government Gunfire ATR from debris on ground (0.20)	39
8	11: 24: 30 to 11:24:32	Black sideFlashes directly to the rear of CEV-2	Alleged Government Gunfire ATR from debris on ground, CEV passes directly over it (0.30)	40
9	11: 24: 50 to 11:24: 51	Black sideFlashes from window B3 or B4 overlooking Cafeteria roof	Alleged Davidian Gunfire from window PSSRs from debris on roof (0.13, 0.20)	24
10	11: 25: 02		Alleged Davidian Gunfire or Government Flash Bang PSSRs from debris on roof (0.13, 0.03, 0.07, 0.03)	20
11	11: 25: 04	Red side Flash on Chapel roof	Alleged Davidian Gunfire PSSRs from debris on roof (0.10)	21
12	11: 26: 27	Black side Flashes near rear right drive sprocket of CEV 2	Alleged Government Gunfire ATR from debris on ground (0.03, 0.03)	41

³ USA National Television Standards Committee (NTSC) video framing rate is 30 frames per second, 2 fields per frame ⁴ Caddell & Chapman – Indications of Gunfire or Heat Flashes on FLIR Tape 3 - 20 Oct 99.

VDS	Time	Event	Alleged Gunfire	Report Figure
(UK) Serial			VDS (UK) Analysis and Flash Durations (seconds)	Number
13	a. 11: 28: 04 to 11: 28: 07	Green sideFlashes in Courtyard in front of Residential Tower	Alleged Government Gunfire PSSRs from falling debris as CEV-2 penetrates Gym (a. image fault, 0.03, 0.07, 0.10, b.	31
	b. 11: 28: 13 to 11: 28: 14		0.70)	
14	a. 11: 28: 18 b. 11: 28: 21	window B4 overlooking	Alleged Davidian Gunfire from window PSSRs from debris on roof in all cases (a. 0.10, b. 0.27)	24
15	11: 28: 22	Black side Flashes on Cafeteria roof	PSSRs from debris on roof (0.27)	24
16	a. 11: 30: 08 b. 11: 30: 14	Green sideFlashes (weak) in Courtyard in front of Residential Tower	PSSRs from fallen Gym debris (a. multiple 0.03, b. multiple 0.03)	31
17	11: 30: 26	Black sideFlashes on Cafeteria roof. Also from window B3 overlooking Cafeteria roof	Alleged Davidian Gunfire from window PSSRs from debris on roof in all cases (0.40, 0.30)	25
18	11: 34: 32	Green sideFlash in Courtyard in front of Residential Tower	Alleged Government Gunfire PSSRs from fallen Gym debris (0.27)	31
19	11: 34: 32	Green sideAlleged man running from destroyed NE corner of Gym to diving platform at corner of Swimming Pool	Alleged Government Agent Wind blown debris material from damaged Gym	32
20	11: 34: 33	Black side Flashes on Cafeteria roof	PSSRs from debris on roof (0.10)	26
21	11: 34: 45	Red side Flash on Chapel roof	` '	21
22	11: 38: 31	Black sideFlash 15 feet in front of CEV-2	Alleged Government Gunfire PSSRs from fallen Gym debris (0.37)	43
23	11: 38: 45	Black sideFlash at black spot at innermost penetration by CEV- 2 into Gym	Alleged Government Gunfire PSSRs from fallen Gym debris (0.73)	42
24	11: 42: 00 to 11: 42: 01	Red side Flash at damaged structure (below window B2)	PSSRs from debris amongst damage (0.07, 0.07, 0.07)	18

VDS	Time	Event	Alleged Gunfire	Report Figure
(UK) Serial			VDS (UK) Analysis and Flash Durations (seconds)	Number
25	11: 43: 33	White sideFlash on single-storey Quarters roof	Alleged Davidian Gunfire PSSRs from debris on roof (0.27)	10
26	11: 43: 35 to 11: 43: 38	White sideFlashes from window B5 overlooking single-storey Quarters roof	Alleged Davidian Gunfire from window PSSRs from very low emmisivity material (0.30, 0.37,	10
27	11: 44: 48	Black side Flash on Cafeteria roof	0.47, 0.23) Alleged Davidian Gunfire towards CEV- 2 or Courtyard PSSRs from debris on roof (0.17)	26
28	11: 44: 52 to 11:44: 53	Black sideFlash on Cafeteria roof - then flash from Residential Tower window C3 followed by multiple flashes on roof	Alleged Davidian Gunfire towards CEV- 2 or Courtyard PSSRs from debris at base of Tower and on roof of Cafeteria (0.17, 0.17, 0.17, 0.03)	26, 29
29	11: 45: 15 to 11: 45: 24	White sideFlashes on single-storey Quarters roof (at flag pole end)	Alleged Davidian Gunfire towards CEV- 1 PSSRs from debris on roof (0.13, 0.27, 0.30)	10
30	11: 46: 32 to 11: 46: 33	Black sideFlash on ground at base of Residential Tower. Also on Cafeteria roof twice	PSSRs from debris at base of Tower and on roof of Cafeteria (0.13, 0.10)	27, 29
31	11: 46: 34	Green sideFlash in Courtyard	Alleged Government Gunfire PSSRs from fallen Gym debris (0.23)	33
32	11: 46: 36	Black sideFlash from window B4 overlooking Cafeteria roof	PSSRs from debris on roof (0.03)	26
33	11: 46: 43	Black sideFlash from Residential Tower window C1	Alleged Davidian Gunfire towards CEV-2 PSSRs from debris at base of Tower (0.13)	29
34	11: 47: 05	White sideFlash from window B5 overlooking single-storey Quarters roof	Alleged Davidian Gunfire towards CEV-1 PSSRs from debris on roof (0.23)	11
35	11: 48: 14	Black sideFlash from window B4 or from Cafeteria roof	PSSRs from debris on roof (0.23)	28
36	11: 49: 01 to 11:49: 07	single-storey Quarters roof	Alleged Davidian Gunfire towards CEV-1 PSSRs from debris on roof (0.43, 0.17, 0.33, 0.20, 0.33)	11, 12
37	11: 50: 17	Black sideFlash in Courtyard - near base of Residential Tower	PSSRs from debris on ground (0.23)	29

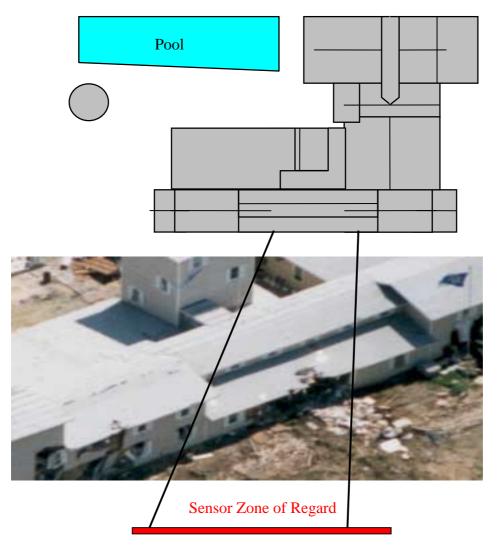
VDS (UK)	Time	Event	Alleged Gunfire VDS (UK) Analysis and Flash	Report Figure Number
Serial			Durations (seconds)	1 (0.112.0 0.2
38	11: 50: 27	Black sideFlash from Residential Tower window C1	Alleged Davidian Gunfire PSSRs from debris on roof (0.37)	30
39	11: 50: 59 to 11: 51: 04	White sideFlashes from window B5 overlooking single-storey Quarters roof. Also on roof near flag pole	Alleged Davidian Gunfire towards CEV-1 PSSRs from debris on roof (0.40, 0.27, 0.27)	12, 13
40	11: 55: 46 to 11:55:47	White sideFlashes from windows B5 and also B6 overlooking single-storey Quarters roof	Alleged Davidian Gunfire PSSRs from debris on roof (0.33, 0.37, 0.33, 0.50)	13
41	11: 57:26 to 11:57:28	White sideFlashes from window B5 overlooking single-storey Quarters roof. Also on roof	Alleged Davidian Gunfire towards CEV-1 PSSRs from debris on roof (0.20, 0.33, 0.33)	14
42	11: 58: 04	White side"Flash" from damaged window B11 as CEV-1 withdraws from main door	Movement of debris out of shadow (0.47)	16
43	11: 59: 03	White sideFlashes on single-storey Quarters roof. Also on roof near damaged area	Alleged Government Flashbang Alternatively, alleged Davidian Gunfire PSSRs from very low emmisivity material (0.40, 0.23)	14
44	12: 00: 40	Black side Flash from several yards behind CEV-2	Alleged Government Gunfire PSSR from fallen Gym debris (0.47)	44
45	12: 01: 06	Red side Flashes on ground in front of Chapel	PSSRs from debris on ground (0.20)	22
46	12: 05: 13 to 12: 05: 16	White sideFlashes from windows B5 and also B6 overlooking single-storey Quarters roof	Alleged Davidian Gunfire towards an M2 Bradley MICV PSSRs from debris on roof (8, 0.33, 0.13, 0.33, 0.57)	15
47	12:07:43	White Side second floor window at tower end.	Active Thermal Signature emanating from inside building.	51
48	12: 07: 51 to 12: 07: 56	Red side Alleged heat source at second floor window B1 at <i>White</i> corner	Active Thermal Signature emanating from inside building - seen through damaged window.	52
49	12: 08: 26	Black side First 'hot' return from cafeteria/kitchen entrance	Probable seat of a fire - separate from that at Red/White corner (Serial 48)	53
50	12: 08: 31	Black sideLong duration flashes from within Gym	Alleged Government Weapon Discharge PSSRs from Walkway window which has dropped onto Gym debris (0.80)	45

VDS (UK) Serial	Time	Event	Alleged Gunfire VDS (UK) Analysis and Flash Durations (seconds)	Report Figure Number
51	12: 08: 50	Green sideFlash near corner of damaged Gym	Alleged Government Gunfire PSSRs from fallen Gym debris	34
		(closest to Tower)	(0.80)	
52	12: 08: 51	,	Alleged Government Gunfire	46
		CEV-2 at Gym	PSSR from debris on ground	
53	12: 09: 00	Green sideFlash on	(0.17, 0.10) Alleged Government Gunfire	47
33	12. 09. 00	Lean-to roof at side of Chapel	PSSRs from fallen window glass (the window under the Satellite Dish) Possibly blown out as a result of the fire (0.23)	47
54	12: 09: 23	Green sideFlash from Inner-Courtyard to right of Residential Tower	Alleged Government Gunfire ATR (as a result of the fire)from debris on ground (0.13)	36
55	12: 10: 21	Black side'Hot' return from rear of collapsed Walkway at Gym	Probably resulting from the spread of fire on Red side	54
56	12: 10: 50	White sidePerson lying on single-storey Quarters roof (near flag pole)	Can be discriminated due to strong object/background tonal variances	55
57	12:11: 00 to 12:11:23	Green sideMultiple flashes in debris in Courtyard	Alleged Government Gunfire ATR (as a result of the fire) from debris on ground	35

9 ALLEGED BRANCH DAVIDIAN GUNFIRE

VDS (UK) was **not tasked** to identify possible Davidian gunfire, but we have included the following analysis for completeness and comparative purposes and to **establish the efficacy of the reflective infrared phenomena on 19 April 1993.**

Alleged Davidian gunfire was reported as emanating from three main areas - at or near rooftops at the White, Red, and Black sides.



White Side Sensor Zone Of Regard

9.1 White Side

Master Event Serials 25,26,29,34,36,39,40,41,42,43 & 46

These thermal events are only apparent when the aircraft is imaging within the nominated Sensor Zone of Regard, when line-of-sight reflectivity is fleetingly met.

Thus, on Tape 3, no alleged Davidian gunfire is observed from (or near) this roof at any other time, even though the roof has been imaged from different angles.

At least one flash occurs on 23 differently timed occasions. These 23 flashes span some 26 minutes in time and occur only when the sensor is in the same position with regard to the sun and to the roof in question.

It is also noteworthy that this roof provides a consistent tonal background on which to observe a thermal return. Moreover, there is a clear correlation between debris on the roof and the thermal flashes, illustrated in the following series of FLIR images, Figures 10-15, compared with the optical colour images.

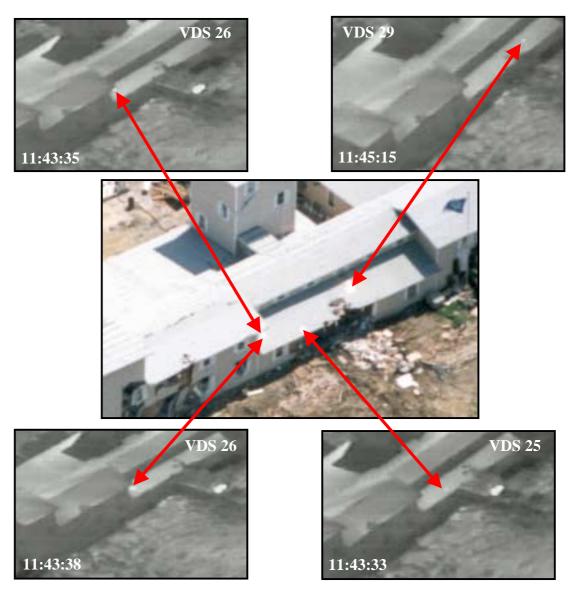


Figure 10- See CD ROM Video Clip # 5 and Attached File

As in Figure 10, there is a clear correlation between glint from the optical image and from the PSSRs on the FLIR imagery at the diverse times illustrated. Yet again, debris on the ground also falls into the Sensor Zone of Regard and therefore the PSSRs are recorded.

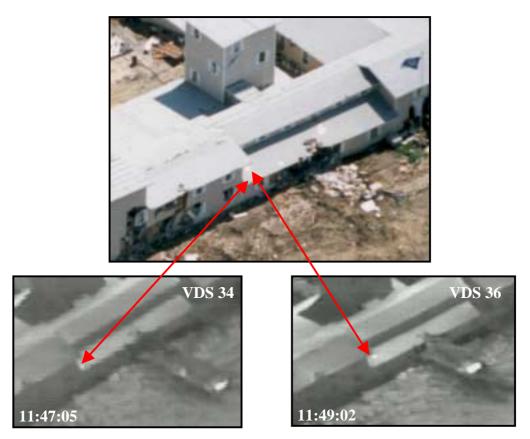


Figure 11

Figure 12 illustrates that the point of origin of the flashes is on the roof in all cases, and not from a nearby window, as alleged.

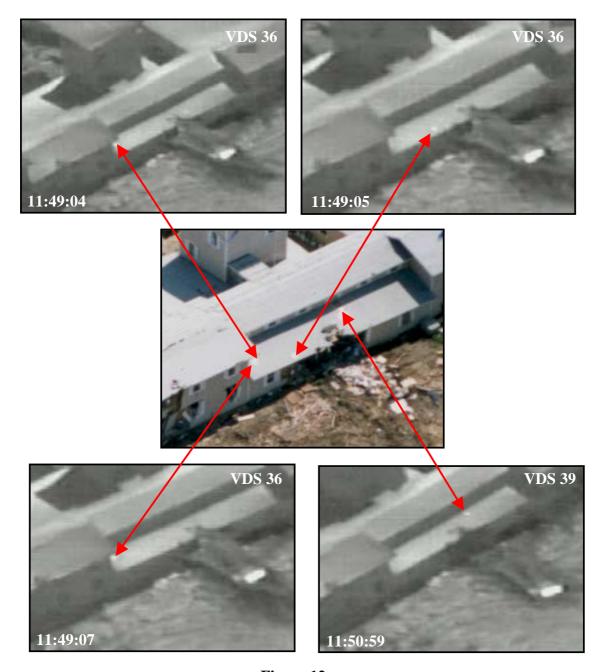


Figure 12

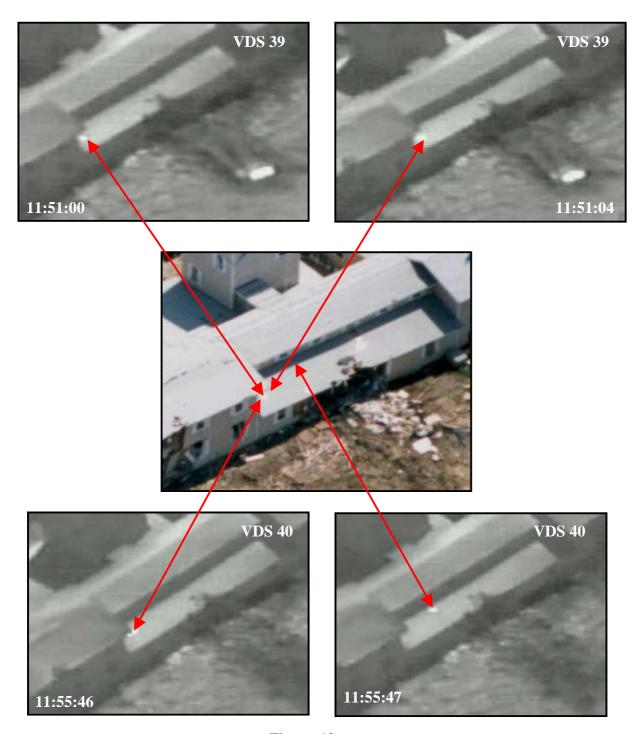


Figure 13

The developing shape of each flash is consistent with a PSSR and is without the directional properties associated with gunfire. Moreover, the duration of the flashes is excessive for gunfire.

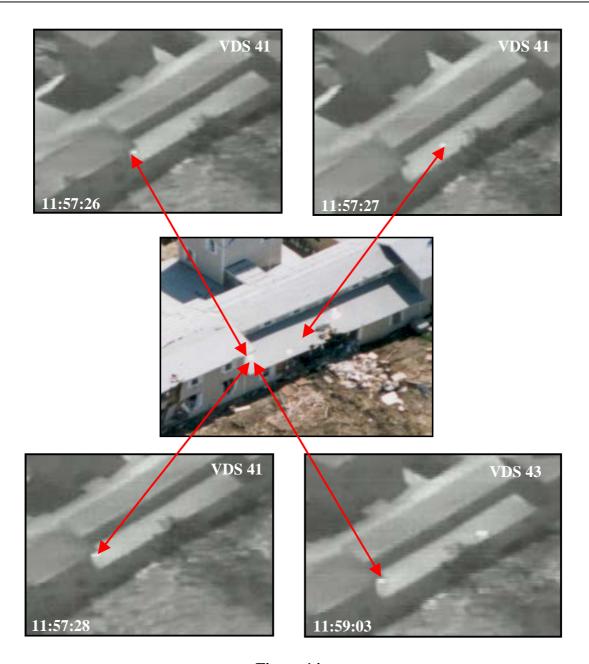


Figure 14

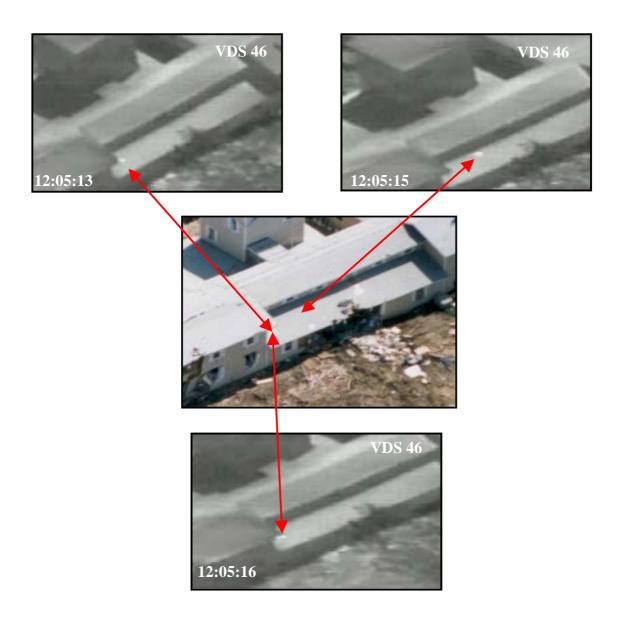


Figure 15

Figure 16 illustrates the remaining event on White side (VDS 42), which is the "flash" that occurs when the CEV penetrates the Main Door. As the CEV withdraws, it pulls out some debris that produces a PSSR.

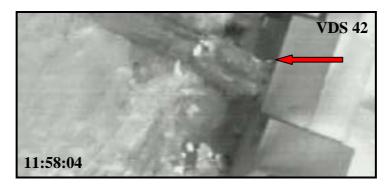


Figure 16 - See CD ROM Video Clip # 6

9.2 Red Side

This group of events is described under two sub headings. The first concerns damage to a window and its surrounding wall, and the second part the alleged gunfire from the Chapel roof.

9.2.1 Damaged Corner (B2 Window)

Master Event Serials 2, 4 & 24

Three observable flashes occur from within the damaged area on different occasions. These flashes span some 48 minutes in time overall. The colour illustration at Figure 37 depicts reflecting material within the debris.

As with the White side events, these flashes are only apparent when the sensor is at the same approximate position to the Sun. However, in this case, the Sun is behind the sensor each time. The FLIR images at Figures 17 and 18 illustrate a PSSR from the same material at the same point (red arrow).



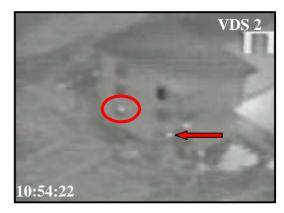
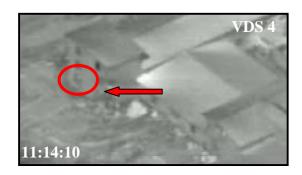


Figure 17



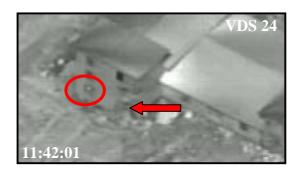
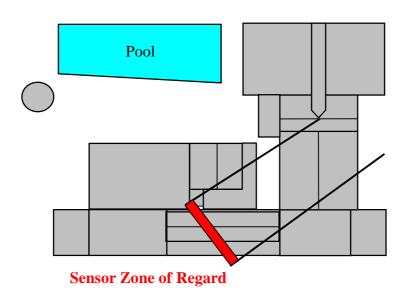


Figure 18

Note also the consistently cold return from one of the upper windows, which is believed to feature a metal blind. More importantly, there is also an ATR from within the room at the lower left (red oval). **This room is in the vicinity of the subsequent fire**, which is discussed in Section 11.

9.3 Events At Red Side On Chapel Roof Master Event Serials 10, 11, 21 & 45



Red Side Chapel Roof Sensor Zone Of Regard

At least three thermal flashes occur from this location, each time when the sensor is in the appropriate Zone of Regard. As with the White side roof, there is correlation with glass debris on the roof (Figure 19).





Figure 19

Analysis of all available imagery illustrates a correlation between shards of window glass deposited on the Chapel roof during the original ATF raid and the PSSRs on the FLIR. Moreover, the following sequence of four FLIR images at Figure 20 (VDS 10) illustrates the PSSR expanding and contracting between consecutive video frames.

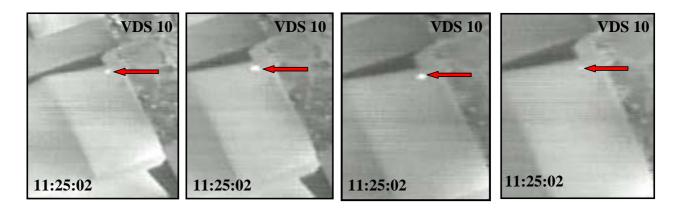


Figure 20 - See CD ROM Video Clip #7

Figure 21 illustrates a similar correlation elsewhere on the roof, two seconds after VDS 10 at 11:25:04 (VDS 11) and also at 11:34:45 (VDS 21).

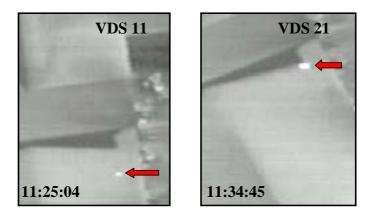


Figure 21

Figure 22 illustrates the return from amongst debris on the ground at 12:01:06 (VDS 45).

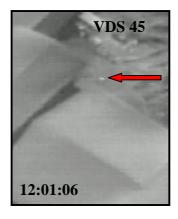
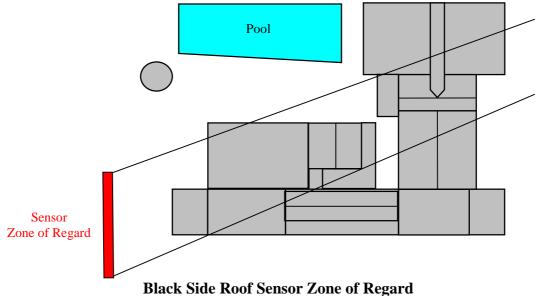


Figure 22

Black Side 9.4

9.4.1 Cafeteria Roof

Master Event Serials 9,14,15,17,20,27,28,30,32,33, 35, 37 & 38.



Returns from this debris-strewn roof show the greatest number of flashes on FLIR Tape 3 at any particular location, and cover a 26-minute period in time. Again, there is discernible correlation between debris and PSSR flashes. Of significance, our analysis indicates that the flashes are *not emanating from the windows* as alleged in some instances, rather from debris strewn on the roof – see Figures 23 and 24.





Figure 23 See Attached Files On CD-ROM - Clip 8





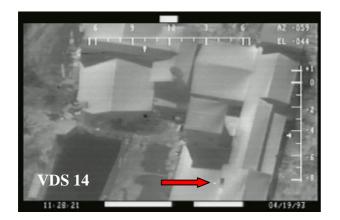




Figure 24

The following sequence also serves to refute the Davidian "gun wad" claim, since it can be seen from the following three sequential images that the supposed "gun wad" (Figure 25, red arrow) precedes the alleged gun flash (Figure 25, yellow arrow). It is also apparent, through the use of stereoscopic techniques, that the alleged gun flash, emanated from PSSR from the roof and not from the window.

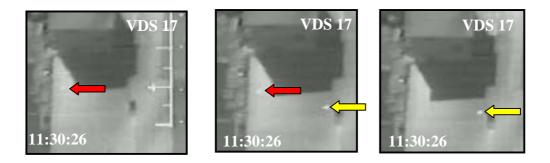


Figure 25 - See CD ROM Video Clip #8

As with all of the sightings on the Cafeteria roof, Figures 26 and 27 reinforce random flash dispersal from PSSRs that match with debris distribution. Once again, the shape, size, distribution, and the flash duration are commensurate with PSSRs from random debris.

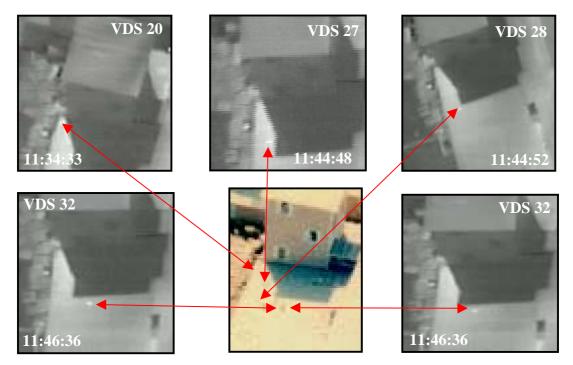


Figure 26

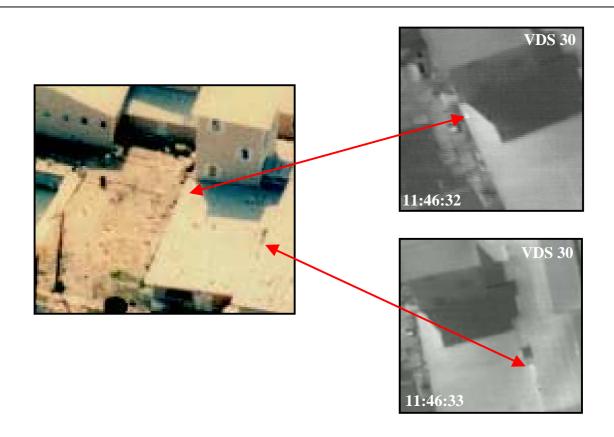


Figure 27

The three FLIR images at Figure 28 demonstrate the pulsating, non-directional nature of the flashes.

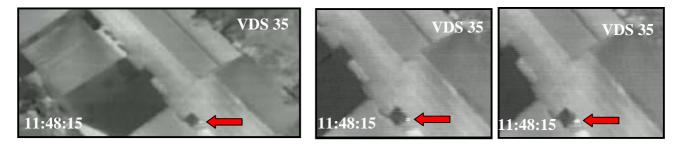
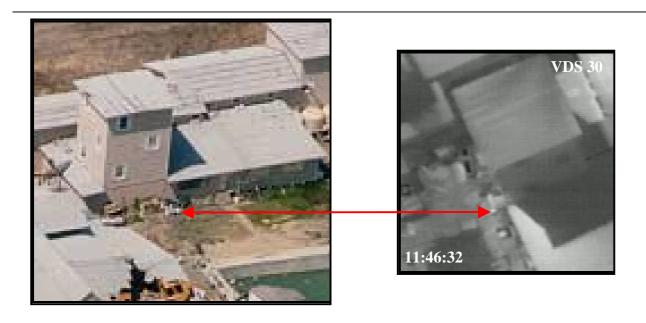


Figure 28

9.4.2 Residential Tower

Master Event Serials 28,30,33,37 & 38

On at least five occasions there is evidence of a flash from the vicinity of the Residential Tower. These flashes were alleged to be gunfire from within the Tower, directed out through the windows. However, Figures 29 and 30 clearly show that the flashes emanate from debris on the ground at the base of the Tower.



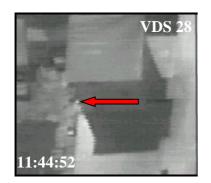






Figure 29

Figure 30 (VDS 38) also illustrates how the PSSR duration is too excessive to be gunfire.





Figure 30

10 ALLEGED GOVERNMENT GUNFIRE

10.1 Criteria For Gunfire

10.1.1 Muzzle Flash FLIR Signatures Derived From FLIR Trial

Shape	Linear, aligned with muzzle elevation and azimuth				
Size	Small, extending some 2-3 feet from muzzle area				
Shadow / Stereo	Flash may be seen above ground level, with a shooter's thermal				
	return				
Tone	Bright light-toned flash				
Associated Features	Always associated with shooter firing position				
Duration	Very short duration flash, visible on FLIR for as little as 0.02 second				

10.1.2 Comparison Of Identified Events With Criteria For Muzzle Flash FLIR Signature

Red 🕹 = Does not meet criteria Green 🖂 = Does meet criteria

Event (VDS(UK) Serial No)	Essential Criteria For A Muzzle Flash FLIR Signature						
	Shape	Size	Shadow / Stereo	Tone	Associated Features	Duration	
5	&	A	\$	\$	*	\$	
7	\$	*	\$	\$	*	\$	
8	\$	*	\$	\$	*	\$	
10	\$	4	&	\$	4	\$	
12	\$	4	&	\$	4	\$	
13	\$	4	&	\$	4	\$	
18	\$	\$	\$	\$	\$	\$	
22	\$		\$	\$	*	\$	
23	\$	*	\$	\$	*	\$	
31	\$	A	\$	\$	\$	\$	
43	\$	À	\$	\$	\$	\$	
44	\$	\$	\$	\$	\$	\$	
50	\$	4	&	\$	4	\$	
51	\$	*	*	\$	*	\$	
52	\$	*	\$	\$	*	\$	
53	\$	Å	&	\$	*	\$	
54	\$	À	\$	\$	\$	\$	
57	\$	*	\$	\$	*	\$	

10.2 Green Side

Master Event Serials 13,16,18,19, 31,51,54 & 57.

Some of these events were alleged to be Government gunfire in the Courtyard at the Green side. However, the flashes evident in this Courtyard are the result of PSSRs from debris that has fallen into the yard as the Gymnasium is damaged by CEV-2. Significantly, **no flashes are seen on any FLIR tapes of this Courtyard prior to the demolition**. Moreover, the object/background thermal discrimination is such that the Government Agents alleged to be firing weapons from these particularly exposed positions would be identifiable on the FLIR tape as the flashes occur. **No personnel are seen in this Courtyard, either on the FLIR tapes or the Colour photographs (Figure 31).**





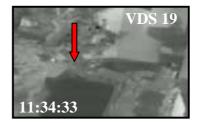




Figure 31

In some instances, the images were subjected to stereoscopic and flicker viewing techniques to enhance perception of where a shooter might be; the 11:34:33 image is a good example of PSSR.





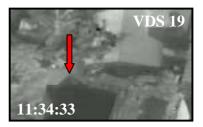


Figure 32 - See CD ROM Video Clip #9

The sequence illustrated at Figure 32 was alleged to show a "man" running from the destroyed NE corner of the Gym to the Swimming Pool diving platform. Image enhancement reveals that the event is caused by wind blown debris.

In order to illustrate the pulsating nature of PSSR flashes seen at VDS 31, Figure 33 is as sequential as possible and shows the flash commencing as a point source, then expanding and contracting.

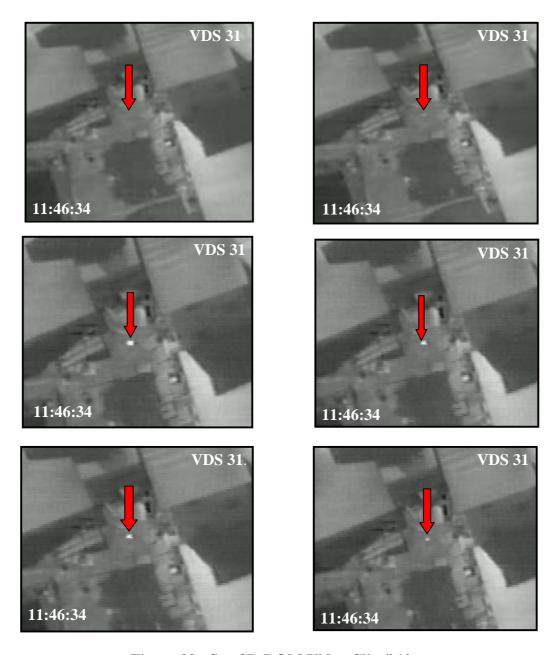


Figure 33 - See CD ROM Video Clip # 10

Figure 34 illustrates VDS 51, caused by PSSR from other debris at a later sun angle.



Figure 34

Once the fire is established, the FLIR shows a number of ATRs from burning materials (arrowed), together with thermal reflections from low-emissivity materials. A number of these ATRs are illustrated below at Figure 35.

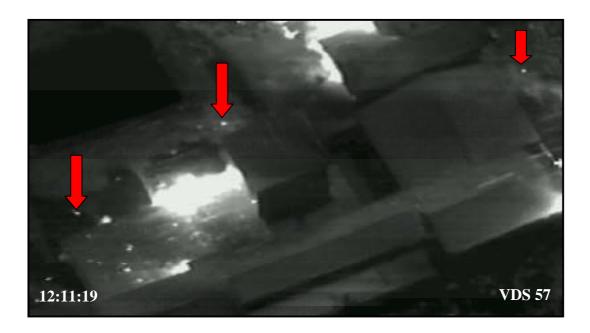


Figure 35 - See CD ROM Video Clip # 11

The series of flashes in the Outer Courtyard have been correlated with previous PSSR events. However, this time (VDS 54) in the Inner Courtyard, the debris is producing an ATR from the Cafeteria – Figure 36.

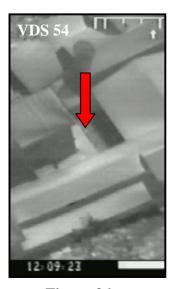
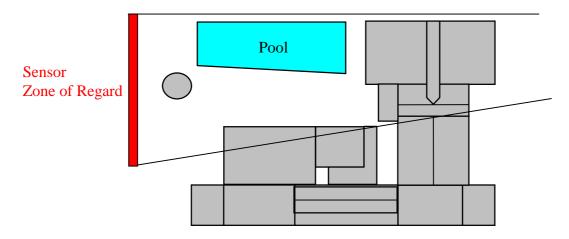


Figure 36

10.3 Black Side Master Event Serials 5,6,7,8,12,22,23,44, 50, 52, & 53



Black Side Gymnasium, Courtyard & Lean-to Roof Sensor Zone of Regard



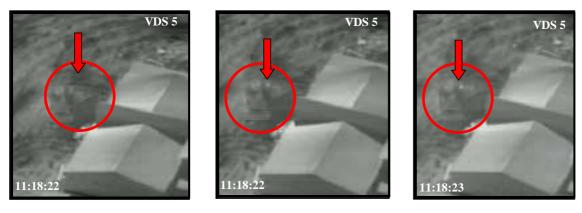


Figure 37 - See CD ROM Video Clip # 12

One of the more difficult events to resolve is VDS Serial 5. A flash is emitted from the left-rear of CEV-1 as it passes the right-hand end of the Gymnasium (Figure 37).

It is alleged that the flash was caused by one of two options; either a weapon such as an M79 grenade launcher or, alternatively, that an agent astride the rear of the CEV fired a shot.

On the first option, analysis reveals that the flash originates from just forward of a box left of the engine that houses the gearing mechanism. The box is a standard item on all CEVs of this type. There is no firing port of any description in this vicinity.

The turret was rotated to the trail position throughout the FLIR coverage, and the turret-mounted fixed smoke dischargers are thus facing rearward. It is not possible to fire either a gun or an M79 through fixed smoke dischargers.

As to the second option, that an agent was astride the rear of the CEV in order to fire into the Gymnasium, this theory is not practicable. Examination of a CEV during the FLIR trial and subsequent detailed imagery analysis refutes the theory that a person would lie or crouch in such proximity to the very hot CEV engine. Our analysis of the FLIR shows that there is no person on the exterior of the vehicle as it starts its journey to the Gymnasium; furthermore, no one climbs aboard during transit.

Stereoscopic viewing indicates that the flash is omni-directional, unlike that of linear muzzle flash.

On the imagery evidence, we conclude that the flash is the result of a PSSR from debris lodged near the box from a previous CEV intrusion into the buildings. The CEV is in the appropriate sensor Zone of Regard at the time of the flash.

Figure 38 (VDS 6) illustrates the effect of falling debris as the CEV penetrates the Gym.



Figure 38



Figure 39

Figure 39 is the first of a series that well illustrate the phenomena of an ATR, with the heat of the CEV engine reflected from debris material nearby when the CEV penetrates the Gymnasium. As with PSSRs, provided the essential angularity between object and sensor is present, then an ATR will be recorded.

This phenomenon is the cause of the events illustrated at Figure 40, where the very hot engine of the moving CEV is reflected in the debris and imaged by the sensor as it obtains the requisite angularity.

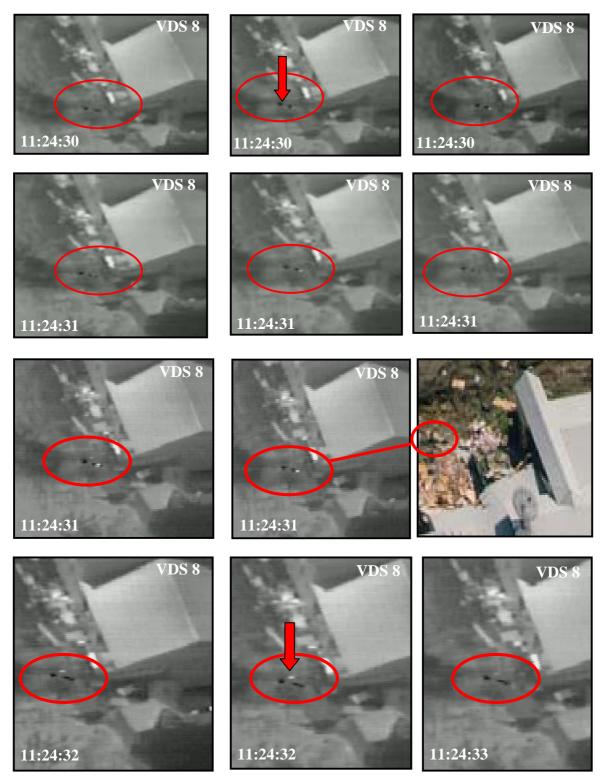


Figure 40

The ATR effect was well demonstrated at the FLIR trial, and is readily apparent here when the CEV is travelling to, and also from, the Gymnasium (Figure 41).







Figure 41

Figure 42 (VDS 23) is a good example of a PSSR that becomes more obvious when viewed stereoscopically when it can be seen that the dark toned material is debris.





Figure 42

The flash illustrated at Figure 43 (VDS 22) is a further PSSR return and takes place within the nominated Sensor Zone of Regard.



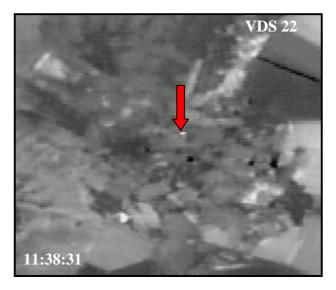


Figure 43

Figure 44 illustrates a further PSSR response from debris (VDS 44)

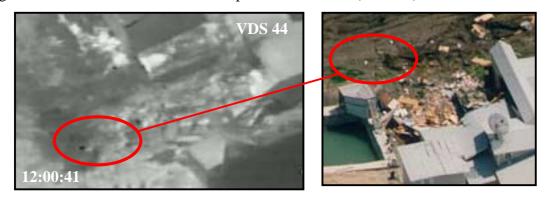


Figure 44

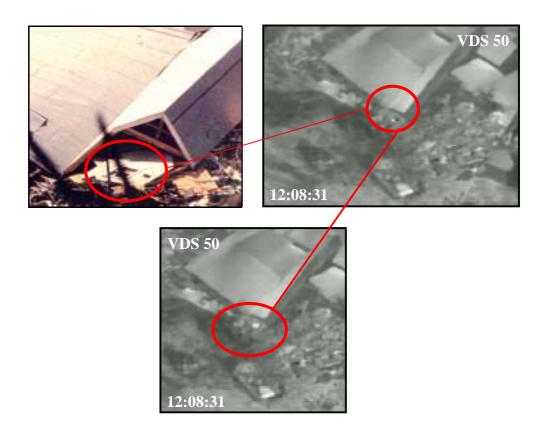


Figure 45 - See CD ROM Video Clip # 13

Event VDS 50 was alleged to be a Government weapon discharge of long duration. From examination of comparative imagery together with the FLIR trial results, it is apparent that the effect is a PSSR from the fallen window illustrated at Figure 45.

The thermal event that takes place to the left of CEV-2 outside of the Gymnasium and illustrated at Figure 46 is a PSSR. In this instance the duration of the flash is also excessive for muzzle flash.

It has also been alleged that the forward hatch of the CEV was opened at 12:08:12 and that a person emerged to take position and fire from the ground at 12:08:51 (VDS 52); this event is illustrated in sequence below.

As the CEV reverses from the gymnasium, the forward deck is in fact covered in debris, and it is this debris blowing in the wind that gives the appearance of a hatch opening.

However, if the CEV is viewed on the FLIR until 12:10:36, it pauses next to the boat-trailer. The colour image clearly illustrates (large red arrow) the debris still in place over the forward deck of the CEV.

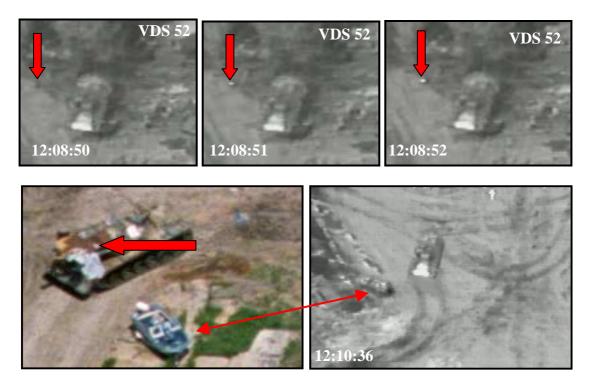


Figure 46 - See CD ROM Video Clips # 14,15

The PSSR flash (Figure 47) evident on the Lean-to Roof (VDS 53) is the result of glass having fallen from the nearby window. The glass may have been blown out as a result of the fire.



Figure 47

10.4 Alleged Gunfire From Government Helicopter

As an adjunct to our work in analysing the FLIR imagery, VDS (UK) was also tasked to comment upon flashes, alleged to be gunfire, seen on two video films of a Government UH-1 helicopter and taken from a ground-based video camera.

At Figure 48 we illustrate 2 un-timed optical video images, taken from a ground video camera, of a UH-1 helicopter in a near hover but beginning to lift and rotate to the left. A flash is seen emanating from the left cockpit side-screen area.





Figure 48- See CD ROM Video Clip # 16

Figure 49 illustrates a helicopter of similar type flying slowly from left to right, without time data available to VDS (UK). Again, on this poor quality image, a flash emanates from the right cockpit side-screen area. This image was taken during the damping down operations after the main fire.





Figure 49 - See CD ROM video Clip 17



Figure 50

Figure 50 illustrates a similar helicopter with rear crew compartment doors open, with weapon(s) mounted in the rear crew compartment, as used by US military forces. The weapons are fired from the open door positions.

The helicopters at Figures 48 and 49 both have the rear crew compartment door closed and the flashes seen are emanating from the forward left quarter and forward right quarter of the cockpit canopy respectively, and not from the area of the rear crew compartment.

We therefore conclude that these flashes are further examples of solar reflection, this time in the visual waveband, and caused by sunlight instantaneously reflected at the video camera from the helicopter canopy side-screens.

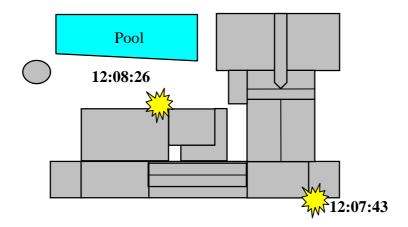
11 ANALYSIS OF THE TIME OF THE START OF THE FIRE

Master Event Serials 47,48,49 & 55

VDS (UK) was tasked to report at what time the fire was first evident on FLIR Tape 3.

The outbreak of the fire on the FLIR is illustrated below. The FLIR was recorded by a circling aircraft, which did not provide continuous coverage of the whole compound all the time. Additionally, the FLIR would be unlikely to record smoke unless the smoke contained hot particulate.

On the FLIR imagery there appears to be two separate, yet closely timed, outbreaks of fire. One occurred at the Red/White corner, and the other at the Cafeteria, illustrated in the diagram below. Our analysis is overleaf



Locations Of The Outbreaks Of Fire Seen On FLIR

11.1 Red / White Corner

Figure 51 illustrates the first FLIR sighting assessed (VDS 47) as 12:07:43, when an ATR return is apparent through the White side window. By 12:09:23 the fire is well under way and obvious from the same window.

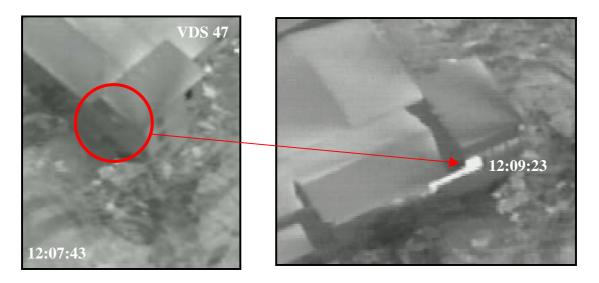


Figure 51 - See CD ROM Video Clip # 18

The thermal return (VDS 48) on Figure 52 is the first indication of the presence of an ATR source within that room on the second floor. The illustration used for VDS 2 (VDS 2 was caused by a PSSR from debris at corner of building) is also included below to provide evidence of a similar return from the room underneath as early as 10:54:22.



Figure 52

11.2 Cafeteria

Figure 53 illustrates a strong ATR at the Cafeteria (VDS 49) at 12:08:26. From the strength of the return, we consider it probable that this thermal signature would have been identified some time earlier, had the FLIR imaged that part of the building earlier.



Figure 53

11.3 Collapsed Walkway

The first thermal evidence of fire in the collapsed Walkway area (VDS 55) is illustrated at Figure 54, starting at 12:10:21 with a rapid build of thermal activity.



Figure 54 - See CD ROM Video Clip # 19

12 SIGHTING OF PERSONNEL

The first sighting of personnel on any FLIR tape (Figure 55) occurs at 12:10:50 (VDS 56) when a person is observed prone on the White side roof. However, on the colour photograph which was probably taken at a slightly different time, he appears crouched on the roof.





Figure 56

Figure 56 is produced in response to the charge that the Bradley MICV discharged gunfire towards the fire. Neither the direction of the flash (arrowed), nor its duration, supports this allegation. The flash is actually an ATR of the fire. Note how personnel (circled) are clearly visible in the contrasting object/background scenario.



Figure 57 - See CD ROM Video Clip 21

Figure 57 provides a further example of personnel, in this instance standing on the tornado shelter. At this time, the object to background discrimination of the shelter roof enabled one

person (red arrow) to be easily seen on the FLIR. The contrast is less obvious for other personnel (yellow arrow) standing at the edge of the shelter at that time.



Figure 58

The FLIR trial report (Figure 58) provides ample evidence of the ability of FLIR to discriminate people in a variety of combat clothing at lower ambient temperatures of $61^{\circ}F - 67^{\circ}F$, and for cold thermal shadows to remain on the ground after those personnel had moved. However, the ambient temperature on 19 Apr 93 was by now around 80° F, and yet personnel are still readily apparent on the FLIR.

Their visibility on the FLIR imagery militates against any hypothesis that humans are less easy to see on FLIR in higher ambient temperatures, when body temperature and the ambient temperature are similar.

On the other hand, there may be occasions of radiometric crossover when humans, and other objects, have the same radiant flux as their background. As a consequence, the sensor system is unable to distinguish between the two and the object disappears. However, it is important to recognise that this is a brief phenomenon. Comparative analysis before, during and after the radiometric crossover event negates the effect of this phenomenon.

Therefore, had people been active on the ground earlier on 19 April 1993, when the ambient temperature was lower, they should have been apparent on the FLIR.

13 CONCLUSIONS

13.1 Background

On 9 September 1999, the Attorney General of the United States of America appointed Senator John C. Danforth to investigate certain events that occurred at the Mt. Carmel Compound in Waco, Texas on 19 April 1993. Immediately after his appointment, Senator Danforth established the Office of Special Counsel (OSC) to carry out this investigation. On 2 December 1999, VDS (UK) was engaged by the OSC and the US District Court for the Western District of Texas to review FLIR imagery taken by an FBI Night Stalker aircraft flying over the Mount Carmel compound on 19 April 1993.

13.2 VDS (UK) Task

VDS (UK) was tasked to determine:

- Whether Government forces fired weapons
- Whether the start time of the fire could be identified on the FLIR
- Whether personnel could be seen on the ground

13.3 Imagery Examined by VDS (UK)

- Examined 4 FLIR tapes and 3 duplicate tapes from the FBI Night Stalker
- Examined hand-held air-to-ground imagery taken by the FBI and relevant to the task
- Examined ground imagery and press coverage and relevant to the task
- Took into account the results of the FLIR trial held at Fort Hood on 19 March 2000

13.4 Master Event List

In addition to 37 instances reported as gunfire-related incidents by the Davidians' experts, VDS (UK) identified a further 20 instances of similar, but unreported, anomalous thermal activity on the FLIR tapes. These 57 incidents were tabulated and each incident was assessed individually. A review of ground video imagery of a Government helicopter in flight was also conducted.

Although tasked only to determine whether Government forces fired weapons, we included a full analysis of possible Davidian gunfire for both completeness and comparative purposes.

Detailed exploitation of the FLIR imagery, together with comparative analysis of the collateral imagery, and of muzzle flash and debris reflection identified during the FLIR trial, was undertaken at our facility in Peterborough, England over the period 4 January to 5 May 2000.

13.5 Analysis

The FLIR videos were viewed to observe individual frames and determine significant features

of each thermal event, the fire and for sightings of personnel. A comparative assessment was undertaken and all of the available FLIR imagery was used, not only the frames finally selected for illustrations to this report.

Collateral imagery (ground & air) was utilised in comparative analysis with the FLIR, using a variety of software and imagery exploitation techniques. Following the FLIR Trial at Fort Hood, we compared the results from that with our assessments in order to reach final conclusions.

13.6 Alleged Government Gunfire

We were unable to identify any gunfire, either from Government forces or from Davidians, from either the FLIR or other collateral imagery available to us.

We concluded that the thermal events and the alleged sighting of a person detailed in the Master Event List were all caused by either Passive Solar Specular Reflection, or by Active Thermal Reflection; with the remainder due to falling and/or wind-blown debris.

Each thermal event was described and attributed in the Master Event List and we provided our analysis of individual events together with illustrations to explain the causes of these thermal events.

The supposed gunfire emanating from the helicopter was assessed to be visible light energy reflection from the helicopter cockpit canopy.

13.7 Time Of The Fire

Our determination of the first outbreak of fire indicated on the FLIR imagery was at 12:07:43 on the second floor of the Red/White corner. A further fire outbreak occurred at 12:08:26 at the cafeteria /kitchen entrance and we provided our analysis and illustrations of the outbreak of fire.

13.8 Personnel

We concluded that throughout the morning of 19 April 1993, no persons were seen, on imagery available to us, until 12:10:50. After 12:10:50, numerous personnel (assumed to be Government personnel by their actions) attended the fire and were clearly visible on the FLIR, despite the relatively high ambient temperature. These personnel were also seen on collateral imagery. We provided our analysis and illustrations to support the analysis.

13.9 Authentication

D D Oxlee Peterborough 5 May 2000

N M EVANS Peterborough 5 May 2000

P AYRES Peterborough 5 May 2000

13.10 Report Distribution

Copies: Qty 1

The Honorable Judge W S Smith
United States District Court for the Western District of Texas
Waco Division
PO Box 608
Waco
Texas 76703-0608
United States of America

Copies: Qty 5 plus 1 for further reproduction, as required

Attn: Mr Brad Swenson Office of Special Counsel 200, North Broadway St Louis Missouri 63102 United States of America

Copies: Qty 1

Vector Data Systems (UK) Ltd

NICK M EVANS

VDS (UK) DIRECTOR OPERATIONS

SUMMARY

Prior to joining VDS (UK) in 1996, Nick Evans had 27 years of policy, management and technical experience in strategic and tactical imagery intelligence operations, having served extensively within the Defence Intelligence Staff at senior level, and most recently as the Command Intelligence Officer (CIO) at HQ Strike Command, an appointment triple-hatted with his Joint Warfare post as JHQ ACOS J2 and NATO position as Assistance Chief of Staff Intelligence, HQ AIRNW. As ACOS J2 he was responsible for intelligence support to all UK out-of-area joint operations including the Gulf and FRY. As CIO he sat on the Project Management Board and was responsible for the co-ordination of all user requirements for the RAF's LYCHGATE C4I system.

As Director Operations, Nick is responsible for the overall program management of all current VDS (UK) programmes, for bid proposals and corporate development.

QUALIFICATIONS

Educated at Barnstaple Grammar School (Devon) and Llandeilo Grammar School (Dyfed), he joined the RAF on a Direct Entry Commission. A Graduate of the Joint School of Photographic Interpretation and the Defence Intelligence and Security School, he has undertaken a full range of Command and Staff training courses appropriate to his rank in the RAF. Has successfully completed courses in advanced sensor interpretation, targeting and tactical questioning techniques.

EXPERIENCE

Vector Data Systems (UK) Ltd

(1996 - Present) Director Operations. Responsible for overall program management of VDS (UK) programmes, bid proposals and corporate development. Recent responsibilities include the RAPTOR programme for DLGS design, integration and maintenance, the GIEF Upgrade program and provision of electronic classrooms to the Defence Intelligence & Security Centre. Acts as senior advisor on all operational and imagery intelligence matters.

(1993-1996) Group Captain, Command Intelligence Officer HQ Strike Command, Assistant Chief of Staff HQ UKAIR/AIRNW, Assistant Chief of Staff J2. Senior Intelligence specialist in the RAF, responsible for staffwork, targeting and intelligence support to all UK operational air forces and out-of-area operations. Liaison with all UK and US intelligence agencies and member of the MOD Defence Intelligence Steering Group. Senior User on the management board of the LYCHGATE project. Managed an operational staff of 95.

(1991-1993) Commanded Operations Wing, JARIC. Management of 225 imagery analysts and support staff. Daily operation of the UK National Imagery Exploitation Programme and production of UK target materials. IMINT support to the Government, Defence Intelligence Staff, UK Intelligence Community and Operational Commanders. Liaison with counter terrorism and counter narcotics organisations, as well as planning support to Special Forces. Reorganised exploitation operations to meet the requirement for improving timeliness and developed softcopy imagery working practices and visualisation products.

(1989-1991) DIS senior Staff Officer responsible for policy for the collection, exploitation, dissemination and archiving of all national intelligence and survey imagery. Formulation of the UK National Imagery Exploitation Programme and provision of IMINT support to operational commanders. Chaired the National Exploitation Sub Committee of the Joint Air Reconnaissance Intelligence Board, for which he acted as executive secretary. Controlled the provision of IMINT and IMINT based products to support UK operations in the build-up to and throughout OP GRANBY.

(1987-1988) DIS senior Staff Officer responsible for recruiting and training policy for the Intelligence Branch and Photographic Interpreter trade group, policy for tactical reconnaissance units, manpower forecasting, LTCs, budget and finance, as well as special security accreditation implementation at sensitive sites.

(1984-1987) Commanded the Harrier Force Reconnaissance Intelligence Centre at RAF Gutersloh, Germany. Responsible for a staff of 105 supporting field-deployed Harrier tactical recce operations. Also responsible for supporting NATO cross-tasked aircraft and a permanent member of the NATO TACEVAL team.

(1982-1984) Commanded a squadron of 40+ imagery analysts at JARIC working upon strategic intelligence imagery; specialised in the missiles and space target environment, including BMD and laser weapons technology. Supported the national imagery exploitation programme.

- (1982) Detached as sole intelligence officer to support all UK flying operations based on Ascension Island during Op CORPORATE. Provided intelligence assessments, assisted in planning, and briefed all long range bombing, ARM, ASW and tanker sorties flown throughout Falkland Islands campaign.
- (1981-1982) Commanded a small team of strategic intelligence imagery analysts at JARIC working on airfield studies. Supported the national imagery exploitation programme.
- (1978-1982) Unit Intelligence Officer supporting all Harrier and Support Helicopter Force operations at RAF Gutersloh, Germany.
- (1976-1978) Commanded the Recognition Materials cell at JARIC, producing innovative reference materials for aircrew, intelligence and imagery analyst staffs of all 3 services.
- (1973-1976) Imagery analyst supporting F4 and Jaguar tactical recce operations at RAF Laarbruch, Germany. Provided conversion training for aircrews. Specialist in optical, IR and SLAR interpretation and responsible for all operational SLAR exploitation.
- (1970-1973) Imagery analyst support to conversion of first Hunter aircrews onto Harrier, and intitial deployments of the embryo Harrier force.
- (1969-1970) Commissioned into RAF as Direct Entrant from school. Initial and professional training.

PETER AYRES

VDS (UK) IMAGERY INTERPRETATION SPECIALIST

SUMMARY

Peter Ayres served in the Royal Air Force as a Photographic Interpreter for 29 years, retiring as the senior Warrant Officer in his trade. He is widely experienced in the practice of both strategic and tactical imagery exploitation and has worked closely with the NATO Committees for air reconnaissance standards. He is a qualified RAF training instructor.

QUALIFICATIONS

Enlisted in the RAF in 1967 since when he graduated from the RAF Photographic Interpretation Course, JSPI; the Remote Sensing and Land Applications of Commercial Satellites Course, Silsoe College; the TADMS Radar Groundstation Operator's Course and the LOCE Intelligence System User's Course. He is also a graduate of the RAF Ground Instruction Technique Course and the RAF Management of Training Course.

EXPERIENCE Royal Air Force (1968 - 1996)

(1988 - 96) Trials Officer in the Reconnaissance Support and Development Cell (RSDC) at JARIC. Evaluated proposed new equipments and compiled detailed reports for MOD. Amended NATO Publications for MOD and represented the UK at the NATO Air Reconnaissance Working Party (ARWP) at NATO HQ, Brussels. Exploited video imagery of aircraft accidents and incidents to support RAF Boards of Enquiry. Developed and operated computer-based, imagery manipulation reference models of systems designed for the exploitation of radar and Tornado infra-red imagery. Evaluated software for imagery exploitation and imagery transmission. Temporary deployed to Incirlik, Turkey as OC the Reconnaissance Intelligence Centre (RIC) supporting Harrier GR7 air reconnaissance operations over northern Iraq.

(1985 - 1988) Operations Officer on II (AC) Squadron RIC, RAF Laarbruch, Germany, controlling 5 PIs and 10 PI(Assistants) employed in tactical optical and infra-red imagery interpretation of imagery collected by the Squadron's Jaguar aircraft

(1984 - 1985) Task Progress Officer in JARIC advising military and civilian personnel on air reconnaissance services and products.

(1980 - 1984) Instructor at the Joint School of Photographic Interpretation, RAF Wyton. Responsible for compiling the training syllabi and the training of PI(A)s. Instructed on the Basic, Tactical and Radar PI Courses.

- (1979 1980) Operations Officer on 41 Squadron RIC controlling PIs and PI(A)s employed in tactical optical and infra-red imagery interpretation of film flown by the Squadron's Jaguar aircraft.
- (1977 1979) PI on 4 (AC) Squadron RIC, RAF Gutersloh, Germany, employed in the exploitation of tactical optical imagery collected by the Squadron's Harrier aircraft.
- (1973 1977) Strategic PI employed at JARIC, RAF Brampton.
- (1972 1973) PI on 13 Squadron, RAF Akrotiri, Cyprus employed on in the exploitation of tactical optical imagery collected by the Squadron's Canberra aircraft, and later at JARIC (NE), RAF Episkopi, Cyprus, employed on strategic PI duties.
- (1968 1972) Employed at JARIC as a Plotter Air Photography and later as a Strategic PI.

DANIEL DAVID OXLEE

VDS (UK) IMAGERY ANALYSIS CONSULTANT

SUMMARY

Daniel David Oxlee commenced as an imagery analyst (IA) with the Royal Air Force in 1954. He subsequently saw service during a number of conflicts starting with Suez and including Malaya, Cyprus, and the Falklands, as well as The Gulf War. Whilst with the military he worked for a number of years on strategic detailed imagery analysis at the Joint Air Reconnaissance Intelligence Centre (JARIC (UK)). Additionally, he has worked with RAF tactical reconnaissance squadrons using the Hunter, Canberra, Phantom, Jaguar and the Harrier during which time he was on the NATO Tactical Evaluation Team. Earlier he was appointed Chief Imagery Analysis Judge on the series of international NATO air reconnaissance competitions. He served on a number of imagery related staff appointments at the Ministry Of Defence. He was awarded the Military OBE in 1983 for his services to intelligence. On retiring from the RAF he joined the Civil Service (CS) as an IA, becoming the Senior Intelligence Officer at the joint School of Photographic interpretation (JSPI) as part of the UK Defence Intelligence & Security Centre, until his retirement from the CS last year. Each year he chairs London based Intelligence, Surveillance, Targeting and Reconnaissance (ISTAR) Conferences involving major air reconnaissance industrial companies. At present he is under contract to lecture on Infrared Imagery Analysis for the MOD, and he is a regular IA lecturer at the Universities of Cambridge, Keele, and the UCI.

As an imagery analysis consultant Daniel is part of the VDS training and analysis team.

QUALIFICATIONS

Educated at South East London Technical College he qualified as a mechanical engineering design draughtsman before being drafted into the RAF as a National Serviceman. A graduate (distinction) of the UK Joint School of Photographic Interpretation, and of the Defence Intelligence and Security School, he attended the appropriate Command and Staff training courses. He qualified as a Class A instructor on advanced multi-sensor and military industrial subjects imagery analysis.

EXPERIENCE

(1999 to present) Specialist IA consultant with Vector Data Systems (UK) Ltd. Senior IA with Kalagate in Forensic Imagery Analysis. Chairman Police Forensic Search Advisory Group. Principle Lecturer with Sira Technology on Thermal IR Analysis

(1987 to 1999) Senior Intelligence Officer at the JSPI at RAF Wyton and latterly at the Defence Intelligence Centre. Responsible for the advanced imagery analysis course at JARIC to include thermal infrared. Also lecturer to UK Police Forces on thermal infrared imagery analysis. Acted as industrial & infrared specialist at JARIC during the Gulf War.

(1986 to 1987) Investigating Officer with the UK Home Office Department.

(1984 to 1986) Commanded Operations Wing, JARIC. Management of around 200 imagery analysts. Daily operation of the UK National Imagery Exploitation Programme and production of UK target materials. IMINT support to the Government, Defence Intelligence Staff, UK Intelligence Community and Operational Commanders. Liaison with counter terrorism and counter narcotics organizations, as well as planning support to Special Forces. First commander of a combined wing to embrace analysis and targeting to meet the requirement for rapid exploitation.

(1982 to 1984) Commanded Imagery Support Wing, JARIC. Management of around 250 imagery technologists in direct and exclusive support of the operational staff.

(1980 to 1982) Commanded the Reconnaissance Support & Development Cell, JARIC (UK). Management of 30 advanced imagery specialists in research for MOD procurement and trials of potential imagery exploitation equipment. Executive member of the Technical & Operational Policy Committee, JARIC. Acted as JARIC's senior IA advisor to MOD staffs during the Falklands War.

(1979 to 1980) Commanded the Joint School of Photographic Interpretation. Management of 30 staff and responsible for the effective training of around 350 officers and tradesmen from the UK military, Foreign and Commonwealth, Civil Service and the Reserve Forces, to include operational command of the Naval and Airforce imagery analyst reserve formations.

(1977 to 1979) Defence Intelligence Staff Officer at the MOD. Responsible for the tasking of all national imagery collection assets through the Chairmanship of the Air Reconnaissance Sub Committee. UK representative on the NATO Imagery Reconnaissance & Intelligence Working Party. UK representative on the CANUKUS Air Reconnaissance Working Party.

(1976 to 1977) Commanded the Joint Air Reconnaissance Intelligence Centre (Near East), Cyprus. Management of around 300 imagery analysts and imagery technologists in support of middle eastern intelligence priorities concerning the rapid exploitation of all air breathing assets.

(1974 to 1976) Commanded the Harrier Force Reconnaissance Intelligence Centre at two locations in RAF Germany. Responsible for a staff of around 100 supporting field-deployed Harrier tactical recce operations. Also responsible for supporting NATO cross-tasked aircraft and a permanent member of the NATO TACEVAL team.

(1973 to 1974) Commanded the Canberra and the Nimrod Reconnaissance Intelligence Centre in Malta. Responsible for a staff of around 75 supporting survey

and operationally deployed aircraft as well as maritime operations. Detached operations in Maseira and in Iran.

(1972 to 1973) Detached duty with the Malaysian Airforce. Acted as specialist adviser on the setting up of an anti terrorist/counter narcotics air reconnaissance squadron using state-of-the-art thermal infrared and optical recording systems. Responsible for creating a viable operational procedure and a sustainable aircrew & analyst training system.

(1970 to 1972) Instructor at JSPI. Headed the syndicate covering multi-sensor subjects, including thermal infrared, together with military industrial subjects.

(1967 to 1970) Commanded a small team of strategic intelligence imagery analysts at JARIC working on military industrial studies. Supported the national imagery exploitation programme.

(1965 to 1967) Imagery analyst supporting the Hunter tactical recce operations at RAF Gutersloh, Germany. Provided visual report training for aircrews.

(1957 to 1965) Imagery analyst working in a number of sections in JARIC on the strategic exploitation off all-source imagery. Also part of a no-notice team deployed on first phase tactical detachments from RAF Wyton.

(1954 to 1957) Assistant photographic interpreter employed at JAPIC, RAF Nuneham Park and at JARIC, RAF Brampton in support of the imagery analysts. Qualified as an IA at JSPI in 1955.

IMAGERY ANALYSIS REPORT FLIR TRIAL FORT HOOD, TEXAS 19 MARCH 2000

PREPARED FOR

THE US DISTRICT COURT FOR THE WESTERN DISTRICT OF TEXAS

AND

THE OFFICE OF SPECIAL COUNSEL

BY



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ATTACHMENT A: Surface Weather Observations

ATTACHMENT B: FLIR Trial Activity

1 BACKGROUND

On 9 September 1999, the Attorney General of the United States of America appointed Senator John C. Danforth to investigate certain events that occurred at the Mt. Carmel Compound in Waco, Texas on 19 April 1993. Immediately after his appointment, Senator Danforth established the Office of Special Counsel (OSC) to carry out this investigation.

In January 2000, VDS (UK) was engaged by the OSC and the U.S District Court for the Western District of Texas to prepare a conditional Protocol for conducting a test of the FLIR technology utilised on 19 April 1993.

VDS (UK) is a UK-registered, majority-owned subsidiary of Vector Data Systems Inc (VDS Inc) and is located in Peterborough, England from where it operates primarily in support of UK Ministry of Defence requirements. The company specialises in providing imagery exploitation ground stations, imagery software and imagery training and consultancy services. The operational and executive control of all VDS (UK) activities is vested in the UK staff, all of whom are UK nationals. VDS (UK) has not previously been under a direct contract to the US government. In 1997 VDS Inc, Alexandria, VA, was acquired by the Anteon Corporation.

VDS (UK) prepared the Protocol and all parties to the civil litigation agreed to the Protocol on 16 February 2000. The Protocol directed that VDS (UK), as the Court's experts, should verify to the U.S. District Court for the Western District of Texas whether the conditions for the Protocol were met satisfactorily during the trial. On 19 March 2000 VDS (UK) certified to the Court that:

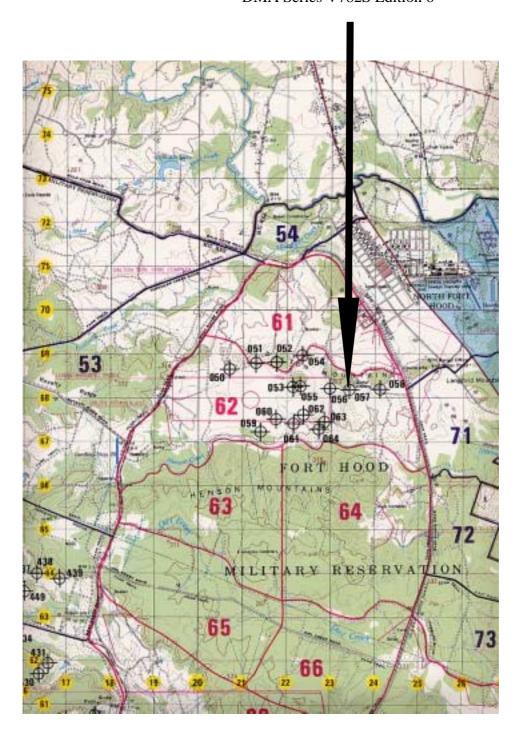
- The FLIR trial was conducted under the conditions of the Protocol at Fort Hood, Texas.
- The trial imagery obtained from the Royal Navy Sea Lynx helicopter Sea Owl FLIR was assessed as having an overall IIRS rating of 7 at 4,000 ft Above Ground Level (AGL) and thus met fully the objectives set forth in the Protocol. As anticipated, the imagery was rated at only IIRS 5 for the 6,000 ft AGL element of the trial.
- Following upgrades to its FLIR system since 1993, the imagery obtained from the FBI Nightstalker FLIR was assessed as having an overall IIRS rating of 8 at both 4.000 ft AGL and 6.000 ft AGL.
- All conditions contained within the Protocol were met to VDS (UK) satisfaction.

2 EXECUTION OF THE FLIR TRIAL

2.1 Reference Data

The FLIR trial was staged at Fort Hood Texas on 19 Mar 2000 using the **Lone Star** range.

Location: UTM Grid 14R PV 234682
Map Sheet: 1: 50,000 Fort Hood MIM
DMA Series V782S Edition 6



2.2 Environment

The trial site was prepared as detailed in Annex A to the Protocol.

Surface weather was acceptable to meet the aims of the Protocol, although flying was delayed from a planned 1030 hrs start to 1100 hrs to allow the surface air temperature to more closely resemble the conditions at Waco of 19 April 1993.

The surface weather observation log is at Attachment A.

2.3 Imagery - General

The imagery requirements detailed at Annex C to the Protocol were met fully.

Details of the trial ground activity and shooting sequences are at Attachment B.

Trial imagery results are at Section 3 and were assessed on the ability of airborne FLIR to capture:

- The tactical movement of personnel under conditions meeting the requirements of the Protocol
- The discharge of a selection of tactical firearms under conditions meeting the requirements of the Protocol
- Thermal signatures (reflected and emitted) of debris likely to have been present on 19 Apr 93, where conditions for recording of reflection or representative sources are met

Extracts from the trial FLIR imagery illustrating these results are included on the accompanying CD-ROM (See Para 2.11 **To View The Enclosed Interactive Video Clips**).

2.4 Lynx FLIR Imagery

The FLIR installed in the Lynx is the same generic sensor type as used in the Night Stalker flown at Waco in April 1993, but with a different installation fit. However, in its normal role as a target acquisition sensor, the Lynx FLIR is displayed in real time to the helicopter crew and not recorded.

To support the occasional requirement to record and replay FLIR imagery, the Lynx can be fitted with a Hi-8 video recorder operating in PAL format at 625 lines. This is the recorder used during the FLIR trial.

Field of view in maximum zoom mode is 2° and the maximum depression angle for the Lynx FLIR is 30°. To acquire IIRS 6 –7 FLIR imagery, representative of the original April 1993 imagery, the Lynx flew at 4,000 ft AGL in a 20° right hand banked attitude. In this attitude, sensor to target slant range was computed as 5,561 ft, at a composite depression angle of 45°.

As mandated in the Protocol, automatic gain control was used, with some resulting degradation to the acquired imagery due to occasional system saturation.

The 4,000 ft AGL Lynx trial imagery was assessed as meeting the required IIRS rating, achieving a rating of IIRS 7 overall. Imagery acquired from 6,000 ft AGL was rated at IIRS 5 overall, as predicted.

2.5 Night Stalker FLIR Imagery

The current FLIR installed in the Night Stalker is a modified version of that used at WACO in April 1993. Modifications relate to improved sensor cooling (with commensurately improved thermal discrimination) and the use of digital assemblies.

Imagery is recorded on NTSC format VHS tapes at 525 lines.

Field of view is 1.7° at maximum zoom and the maximum depression angle for the Night Stalker FLIR is 60°. When compared to the Lynx, this enables the Night Stalker to position itself closer to overhead the target without dramatically increasing the angle of bank. In turn, this leads to a reduced sensor to target slant range and the ability to image in a more vertical mode, thereby providing an improved radiant flux; conversely thermal discrimination reduces as oblique slant range increases. Moreover, the narrower field of view provides slightly larger scale imagery than that from the Sea Owl FLIR.

As mandated in the Protocol, automatic gain control was used, with some resultant degradation to the acquired imagery due to occasional system saturation.

The 4,000 ft AGL Night Stalker trial imagery was assessed as easily meeting the required IIRS rating, achieving a rating of IIRS 8 overall. Imagery acquired from 6,000 ft AGL was also rated at IIRS 8 overall.

Both the Lynx and Night Stalker aircraft imaged a full sequence of fire from 4,000 ft AGL and 6,000 ft AGL.

2.6 Trial Site Area

The trial site area was prepared as detailed at Annex D to the Protocol. The trial site area is detailed at Figure 1.



Figure 1 Trial Site Area

2.7 Firearms and Combat Dress

The firearms and combat dress for the firing sequences proposed in Annex E to the Protocol were all available and utilised as detailed below.

FIRING	WEAPON	COMBAT DRESS					
LANE							
A	Heckler & Koch 9mm	Green Nomex flight suits, camouflage					
	MP5 (suppressed)	webbing utilities, body armour with					
		plate, ballistic helmets.					
В	Remington Automatic	Green Nomex flight suits, camouflage					
	shotgun M870 12g	webbing utilities, body armour with					
		plate, ballistic helmets.					
С	Heckler & Koch 9mm	Green Nomex flight suits, camouflage					
	MP5	webbing utilities, body armour with					
		plate, ballistic helmets.					
D	Rifle M16 .223 w/M203						
E	CAR-15	Full Sniper ghillie suit, face paint and					
		appropriate vegetation adornment					
F	Browning 88 9mm pistol	Camouflaged fatigues and special rain					
		suit					
G	M 60	Camouflaged fatigues and standard					
		issue webbing utilities					
Н	Mk-19	Camouflaged fatigues and standard					
		issue webbing utilities					
Shooter from	M-79 launcher	Camouflaged fatigues and standard					
the Bradley		issue webbing utilities					

2.8 Firing Lane Allocation

The trial shooters were allocated firing lanes as detailed in the Protocol. An example of lane allocation is shown at Figure 2.



Figure 2 Firing Lane Allocation

2.9 Control and Communications

Operational control of all aspects of the trial was undertaken by VDS (UK). Tactical control of aircraft was exercised through an Air Boss, tactical control of shooters was exercised through a Range Controller.

Voice communications to support the FLIR trial were established as follows:

- Air Boss to Lynx (call sign Navy 319)
- Air Boss to Night Stalker (call sign Marla 01)
- Range Controller to shooters
- Range Controller to Lynx and Night Stalker

All voice communications were recorded on the aircraft FLIR tapes, as well as the three ground-based video cameras.

2.10 Report Terminology

Some terminology used in this report is, of necessity, specialist in nature and subject to national variation.

However, in this report the term **Passive** refers to a return on the FLIR imagery that is the result of *solar action*, whilst the term **Active** indicates that the source of the emission stems from *mankind* (for example a running engine).

Although **Temperature** is the dominant factor in determining the strength of a thermal return on FLIR, other factors such as the of type of **Material**, the **Surface Texture**, the **Slant Range** from a target, and the **Imaging Aspect** must be considered during detailed imagery analysis.

It is important to note that, although the majority of commonplace materials have the property to absorb and to subsequently re-emit radiant energy to varying degrees in the long-wave part of the electromagnetic spectrum, items such as glass and polished metals are very poor emitters in this respect.

In the **passive** sense some glass / polished metals have the ability to reflect more than one-third of the thermal energy incident upon them. Thus, with the right imaging aspect, a considerable amount of energy can be reflected back to the sensor system, if the sensor system is moving relative to the Sun angle. The **passive** effect is here termed **Passive Solar Specular Reflection.**

In the **active** sense, the same materials can reflect mankind-derived energy to the sensor system, given the right imaging aspect. The **active** effect is here termed **Active Thermal Reflection**.

2.11 To View The Enclosed CD-ROM Interactive Video Clips

- You will need a PC equipped with CD-ROM drive and web browser / media player
- Insert the CD into your CD player
- Select *Run* from your *Start* menu
- Double click the *FLIR Trial* folder to open the folder

- Double click the *Index* icon to open the Index
- When the Analysis Package Index opens, click <u>VDS</u>
- When the Video Package window opens, click <u>VDS</u>
- To play the video clips, click <u>Play Video Clip</u> as required, and Attached Files as required

2.12 To View Each Video Clip As A Continuous Loop

- Select your Media Player whilst viewing a video clip
- Select the *Edit* pull down menu
- Click Options
- Select Auto Repeat / Continuous Play
- Click OK

3 TRIAL IMAGERY RESULTS

3.1 Imagery Duplication

The original trial FLIR Hi 8 tape from the Lynx was assessed as meeting the requirements of the Protocol at IIRS 7 by VDS (UK) personnel at Fort Hood.

Subsequently, the OSC generated and distributed a digital copy of the FLIR filed on a 20Gb hard drive; this digital copy enabled repetitious viewing of the video without degradation of the original tape due to multiple replays, but showed some loss of detail.

An OSC-generated NTSC format VHS tape of the Lynx FLIR was used by VDS (UK) to extract short video sequences and to conduct frame-by-frame exploitation as necessary.

Copies of the Night Stalker FLIR were similarly generated by OSC in digital format, supported by an NTSC format VHS tape.

3.2 Imagery Exploitation

The trial FLIR imagery was exploited on our Desktop Imagery Exploitation Workstation (DIEWS) which includes the following commercially available software packages:

- Falcon View
- Digital Imagery Exploitation Production System
- Remote View
- Raindrop
- Adobe Photoshop
- Adobe Premiere

Video-based supporting illustrations were generated using National Technology Alliance Digital Video Analyser Version 4.0.4.

The trial imagery was used to establish the ability of IIRS 6 / 7 FLIR imagery to identify the following:

- The tactical movement of personnel
- The discharge of a selection of tactical firearms
- Thermal signatures (reflected and emitted) of debris

Illustrations from the Lynx FLIR trial imagery are included in the following paragraphs. Where it has been helpful to illustrate a particular point, illustrations from the Night Stalker FLIR have also been included.

3.3 The Tactical Movement Of Personnel

On the Lynx FLIR imagery the shooter personnel were visible at all times. There were times when the shooters were less clearly visible, due to the imaging aspect and the thermal response from the surrounding ground features. However, using various softcopy imagery exploitation packages, VDS (UK) was able to confirm the presence of all the shooters on the imagery, at all times.

3.3.1 Lynx Helicopter Series 1, Sequence 1, Round 1

Figure 3 timed at 11:01:57.54 illustrates the shooters in the prone position, behind the armoured vehicles.



Figure 3 Shooters In Prone Position

See CD ROM Video Clip # 1

Figure 4 timed at 11:02:01.76 illustrates the shooters moving forward to the firing positions. Cold thermal shadows are clearly seen where the shooters were previously in the prone position.



Figure 4 Shooters Moving Forward See CD ROM Video Clip # 2

3.4 The Discharge Of A Selection Of Tactical Firearms

Where weapon muzzle flashes are observed, they are detailed by time, shooter number, lane allocation and the weapons used.

3.4.1 Lynx Helicopter Series 1, Sequence 2, Round 1

Figure 5 timed at 11:09:27.46 illustrates a weapon muzzle flash from Shooter 5 in firing lane E (CAR-15).



Figure 5 Muzzle Flash – Car-15 See CD ROM Video Clip # 3

3.4.2 Lynx Helicopter Series 1, Sequence 2, Round 2

Figure 6 timed at 11:09:53.60 illustrates a weapon muzzle flash from Shooter 2 in firing lane B (Shotgun).



Figure 6 Muzzle Flash – Shotgun See CD ROM Video Clip # 4

3.4.3 Lynx Helicopter Series 1, Sequence 3, Round 1

Figure 7 timed at 11:15:56.94 illustrates a weapon muzzle flash from Shooter 7 in firing lane G (M-60).



Figure 7 Muzzle Flash – M-60 See CD ROM Video Clip # 5

3.4.4 Lynx Helicopter Series 1, Sequence 3, Round 1

Figure 8 timed at 11:16:19.22 illustrates a weapon muzzle flash from Shooter 8 in firing lane H (Mk-19). A further flash is observed at 11:16:19.56



Figure 8 Muzzle Flash – Mk-19 See CD ROM Video Clip # 6

3.4.5 Lynx Helicopter Series 1 Sequence 3, Round 1

Figure 9 timed at 11:16:59.40 illustrates a weapon muzzle flash from Shooter 5 in firing lane E (CAR-15).



Figure 9 Muzzle Flash - CAR-15 See CD ROM Video Clip # 7

3.4.6 Lynx Helicopter Series 1 Sequence 3, Round 3

Figure 10 timed at 11:18:01.04 illustrates a weapon muzzle flash from Shooter 5 in firing lane E (CAR-15). A further muzzle flash is observed at 11:18:01.12.



Figure 10 Muzzle Flash – Car-15 See CD ROM Video Clip # 8

3.4.7 Lynx Helicopter Series 1 Sequence 3, Round 3

Figure 11 timed at 11:18:30.74 illustrates a weapon muzzle flash from Shooter 8 in firing lane H (Mk-19). A further muzzle flash is observed at 11:18:30.92.



Figure 11 Muzzle Flash – Mk-19 See CD ROM Video Clip # 9

3.4.8 Lynx Helicopter Series 2, Sequence 3, Round 1

Figure 12 timed at 11:54:16.60 illustrates a weapon muzzle flash from Shooter 5 in firing lane E (CAR-15).



Figure 12 Muzzle Flash CAR-15 See CD ROM Video Clip # 10

3.4.9 Lynx Helicopter Series 2, Sequence 3, Round 1

Figure 13 timed at 11:55:40.26 illustrates a weapon muzzle flash from Shooter 8 in firing lane H (Mk-19).



Figure 13 Muzzle Flash – Mk-19 See CD ROM Video Clip # 11

3.4.10 Lynx Helicopter Series 2, Sequence 3, Round 3

Figure 14 timed at 12:03:23.06 illustrates a weapon muzzle flash from Shooter 5 in firing lane E (CAR-15). A further flash is observed at 12:03:23.58.



Figure 14 Muzzle Flash – CAR-15 See CD ROM Video Clip # 12

3.4.11 Lynx Helicopter Series 2, Sequence 3, Round 3

Figure 15 timed at 12:03:40.78 illustrates the airborne detonation of a flashbang round fired by Shooter 4 in firing lane D (M-16).



Figure 15 Detonation of Flashbang See CD ROM Video Clip # 13

3.4.12 Lynx Helicopter Series 2, Sequence 3, Round 3

Figure 16 timed at 12:23:23.00 illustrates the airborne detonation of a flashbang round fired by Shooter 9 outside the Bradley. A similar detonation is seen at 12:23:44.96.



Figure 16 Detonation of Flashbang See CD ROM Video Clip # 14

3.4.13 Lynx Helicopter Series 2, Sequence 4

Figure 17 timed at 12:22:21.16 illustrates a weapon muzzle flash (Ferret Round) from the shooter outside of the Bradley (M-79 Launcher). The flash is aligned with the muzzle which is elevated at approximately 45° to the horizontal. A similar flash is seen at 12:22:33.60.



Figure 17 Muzzle Flash M-79 See CD ROM Video Clip # 15

3.5 Thermal Signatures (Reflected And Emitted) Of Debris

The trial debris area was constructed in accordance with Annex D of the Protocol. Ground imagery of the debris area layout is shown at Figure 18.











Figure 18 Trial Debris Layout

3.5.1 Lynx Helicopter

Figure 19 timed at 11:04:54.26 illustrates a Passive Solar Specular Reflection from the trial debris area.



Figure 19 Passive Solar Specular Reflection From Debris See CD ROM Video Clip # 16

3.5.2 Lynx Helicopter

Figure 20 timed at 11:55:55.50 illustrates a Passive Solar Specular Reflection from the debris area.



Figure 20 Passive Solar Specular Reflection From Debris See CD ROM Video Clip # 17

3.5.3 Lynx Helicopter

Figure 21 timed at 11:56:06.20 illustrates a Passive Solar Specular Reflection from the debris area.



Figure 21 Passive Solar Specular Reflection From Debris See CD ROM Video Clip # 18

3.5.4 Lynx Helicopter

Figure 22 timed at 11:56:00.32 illustrates a Passive Solar Specular Reflection from the debris area.



Figure 22 Passive Solar Specular Reflection From Debris See CD ROM Video Clip # 19

3.5.5 Night Stalker

Figure 23 timed at 13:20:03 illustrates an Active Thermal Reflection from the debris located under the CEV, created by heat from the engine bay area being reflected from the debris.



Figure 23 Active Thermal Reflection See CD ROM Video Clip # 20

3.5.6 Night Stalker

Figure 24 timed at 13:49:51 illustrates an Active Thermal Reflection from the debris located under the CEV, created by heat from the engine bay area being reflected from the debris.



Figure 24 Active Thermal Reflection See CD ROM Video Clip # 21

3.6 Comparison Between FLIR Signatures Of Muzzle Flash and Debris

3.6.1 Muzzle Flash

- Shape linear, aligned with muzzle elevation and azimuth
- Size small, extending some 2 3 feet from muzzle area
- Shadow does not apply, but when viewed in stereo is seen elevated above ground level
- Tone bright light toned flash
- Associated features always associated with shooter firing weapon
- Duration very short duration flash visible on FLIR for 0.02 seconds or less

3.6.2 Debris

- Shape not always linear, may be associated with shape of reflecting object
- Size associated with size of reflecting object
- Shadow does not apply
- Tone bright flash, intensity varies according to reflectivity of debris
- Associated features collateral imagery will reveal nature of debris / material generating the specific thermal response
- Duration much longer duration than muzzle flash, visible for varying times, but can be 0.40 seconds or longer

4 CONCLUSIONS

VDS (UK) was engaged by the OSC and the U.S District Court for the Western District of Texas to conduct a test of the FLIR technology utilised by the FBI on 19 April 1993.

The FLIR trial was conducted under the conditions of the agreed Protocol at Fort Hood, Texas on 19 March 2000.

All conditions contained within the Protocol were met to VDS (UK) satisfaction.

The FLIR trial collected Lynx IIRS 7 FLIR imagery from 4,000 feet AGL; IIRS 5 FLIR imagery from 6,000 feet AGL was also collected from the Lynx and IIRS 8 imagery from both 4,000 and 6,000 feet AGL by the Night Stalker. Ground activity imaged included the tactical movement of personnel, the discharge of a selection of tactical firearms and thermal signatures (both reflected and emitted) of debris likely to have been present at Waco on 19 Apr 93.

Our analysis of the Lynx IIRS 7 FLIR imagery indicates the following:

- Personnel can be seen throughout the duration of the trial, even when dressed in a wide variety of combat clothing.
- Muzzle flashes from the tactical firearms employed in this trial are identifiable from a variety of sensor aspects, heights and from IIRS 7 (and IIRS 5) ratings. These muzzle flashes can be discriminated from the reflected and emitted thermal signatures of debris using imagery analysis techniques.
- Reflected and emitted thermal signatures of debris are identifiable from a variety of sensor aspects, heights and from IIRS 7 (and IIRS 5) ratings. Reflected and emitted thermal signatures can be discriminated from the muzzle flashes of the tactical firearms employed in this trial using imagery analysis techniques.

5 REPORT DISTRIBUTION

Copy #1

The Honorable Judge W S Smith
United States District Court for the Western District of Texas
Waco Division
PO Box 608
Waco
Texas 76703-0608
United States of America

Copy #2

Senator J C Danforth Office of Special Counsel 200 North Broadway St Louis Missouri 63102 United States of America

Copy #3

Vector Data Systems (UK) Ltd Anteon House Newark Road Peterborough PE1 5FL England

ATTACHMENT A TO FLIR TRIAL REPORT VDS/392/4

SURFACE WEATHER OBSERVATIONS

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LYNX - SERIES 1 - HEIGHT 4000 FT AGL 19-Mar-00

 PLANNED START TIME
 1100
 ACTUAL START TIME
 1101

 PLANNED STOP TIME
 1130
 ACTUAL STOP TIME
 1129

SEQUENCE 1: 5 ROUNDS SINGLE SHOT

ACTUAL START TIME 1101
ACTUAL STOP TIME 1108

SHOOTER	WEAPON	MOVE TO POSITION	ROUND 1	ROUND 2	ROUND 3	ROUND 4	ROUND 5	COMMENTS
Α	H&K MP-5 SUPPRESSED							
В	870 SHOTGUN							Stoppage round 4, restart 1106
С	H&K MP-5							
D	M-16							
Е	CAR-15							
F	9MM BROWNING							
G	M-60							
Н	MK-19							
ı	M-79							

SEQUENCE 2: 3 ROUNDS OF 3 SHOT BURSTS

ACTUAL START TIME 1109
ACTUAL STOP TIME 1114

SHOOTER	WEAPON	MOVE TO POSITION	ROUND 1	ROUND 2	ROUND 3	ROUND 4	ROUND 5	COMMENTS
Α	H&K MP-5 SUPPRESSED							
В	870 SHOTGUN							
С	H&K MP-5							Stoppage round 2, restart 1112
D	M-16							
E	CAR-15							
F	9MM BROWNING							
G	M-60							
Н	MK-19							
ī	M-79							

SEQUENCE 3: 3 ROUNDS OF FULL AUTOMATIC OR FLASHBANG

ACTUAL START TIME 1115
ACTUAL STOP TIME 1118

SHOOTER	WEAPON	MOVE TO POSITION	ROUND 1	ROUND 2	ROUND 3		COMMENTS
Α	H&K MP-5 SUPPRESSED						
В	870 SHOTGUN					_	
С	H&K MP-5						
D	M-16						
E	CAR-15						
F	9MM BROWNING						
G	M-60						
Н	MK-19				<u>"</u>		
ı	M-79						

SEQUENCE 4: M-79 FERRET / M651 / FLASHBANG

ACTUAL START TIME 1119
ACTUAL STOP TIME 1124

SHOOTER	WEAPON	MOVE TO POSITION	FERRET 1	FERRET 2	M651 1	M651 2	FLASH BANG 1	FLASH BANG 2	COMMENTS
Α	H&K MP-5 SUPPRESSED								
В	870 SHOTGUN								
С	H&K MP-5								
D	M-16								
E	CAR-15								
F	9MM BROWNING								
G	M-60								
Н	MK-19								
I	M-79								

SEQUENCE 5: CEV UNCOVERS DEBRIS UNDER CHASSIS

ACTUAL START TIME 1128
ACTUAL STOP TIME 1129

19 Mar 00

VEHICLE	MOVE FORWARD	EXPOSE DEBRIS	MOVE BACK	COMMENTS	
CEV					

LYNX - SERIES 2 - HEIGHT 6000 FT AGL

PLANNED START TIME	1136	ACTUAL START TIME	1137	
PLANNED STOP TIME		ACTUAL STOP TIME	1224	

SEQUENCE 1: 5 ROUNDS SINGLE SHOT

ACTUAL START TIME 1137
ACTUAL STOP TIME 1140

SHOOTER	WEAPON	MOVE TO POSITION	ROUND 1	ROUND 2	ROUND 3	ROUND 4	ROUND 5	COMMENTS
Α	H&K MP-5 SUPPRESSED							
В	870 SHOTGUN							
С	H&K MP-5							
D	M-16							
Е	CAR-15							
F	9MM BROWNING							
G	M-60							
Н	MK-19							
I	M-79							

SEQUENCE 2: 3 ROUNDS OF 3 SHOT BURSTS

ACTUAL START TIME 1144
ACTUAL STOP TIME 1147

SHOOTER	WEAPON	MOVE TO POSITION	ROUND 1	ROUND 2	ROUND 3	COMMENTS
Α	H&K MP-5 SUPPRESSED					
В	870 SHOTGUN					
С	H&K MP-5					
D	M-16					
Е	CAR-15					
F	9MM BROWNING					
G	M-60					
Н	MK-19					
ı	M-79					

SEQUENCE 3: 3 ROUNDS OF FULL AUTOMATIC OR FLASHBANG

ACTUAL START TIME 1147 Stoppage 1157 sensor problem
ACTUAL STOP TIME 1203

SHOOTER	WEAPON	MOVE TO POSITION	ROUND 1	ROUND 2	ROUND 3	COMMENTS
Α	H&K MP-5 SUPPRESSED					
В	870 SHOTGUN					
С	H&K MP-5					
D	M-16					
Е	CAR-15					Stoppage round 1 to 1153
F	9MM BROWNING					
G	M-60					
Н	MK-19					
ı	M-79					

SEQUENCE 4: M-79 FERRET / M651 / FLASHBANG

ACTUAL START TIME 1204 RESTART 1221 Sequence aborted due to weapon malfunction, restarted after sequence 5 at 1221 ACTUAL STOP TIME 1212 STOP 1224

SHOOTER	WEAPON	MOVE TO POSITION	FERRET 1	FERRET 2	M651 1	M651 2	FLASH BANG 1	FLASH BANG 2	COMMENTS
Α	H&K MP-5 SUPPRESSED								
В	870 SHOTGUN								
С	H&K MP-5								
D	M-16								
Е	CAR-15								
F	9MM BROWNING								
G	M-60								
Н	MK-19								
ı	M-79								Aborted and restarted 1221

SEQUENCE 5: CEV UNCOVERS DEBRIS UNDER CHASSIS

ACTUAL START TIME 1217
ACTUAL STOP TIME 1218

FLIR TRIAL - FORT HOOD TEXAS

VEHICLE	MOVE FORWARD	EXPOSE DEBRIS	MOVE BACK	COMMENTS	
CEV					

NIGHT STALKER - SERIES 1 - HEIGHT 4000 FT AGL

PLANNED START TIME	1215 AC	TUAL START TIME	1305	Temperature on site 67F
PLANNED STOP TIME	AC	TUAL STOP TIME	1302	

SEQUENCE 1: 5 ROUNDS SINGLE SHOT

ACTUAL START TIME	1305
ACTUAL STOP TIME	1308

SHOOTER	WEAPON	MOVE TO POSITION	ROUND 1	ROUND 2	ROUND 3	ROUND 4	ROUND 5	COMMENTS
Α	H&K MP-5 SUPPRESSED							
В	870 SHOTGUN							
С	H&K MP-5							
D	M-16							
Е	CAR-15							
F	9MM BROWNING							
G	M-60							
Н	MK-19							
I	M-79							

SEQUENCE 2: 3 ROUNDS OF 3 SHOT BURSTS

ACTUAL START TIME 1309
ACTUAL STOP TIME 1311

SHOOTER	WEAPON	MOVE TO POSITION	ROUND 1	ROUND 2	ROUND 3	COMMENTS
Α	H&K MP-5 SUPPRESSED					
В	870 SHOTGUN					
С	H&K MP-5					
D	M-16					
E	CAR-15					
F	9MM BROWNING					
G	M-60					
Н	MK-19					
I	M-79					

SEQUENCE 3: 3 ROUNDS OF FULL AUTOMATIC OR FLASHBANG

ACTUAL START TIME 1312
ACTUAL STOP TIME 1317

SHOOTER	WEAPON	MOVE TO POSITION	ROUND 1	ROUND 2	ROUND 3		COMMENTS
Α	H&K MP-5 SUPPRESSED						
В	870 SHOTGUN						
С	H&K MP-5						
D	M-16						
Е	CAR-15						
F	9MM BROWNING						
G	M-60						Jammed rounds 2 & 3
Н	MK-19						
ı	M-79						

SEQUENCE 4: M-79 FERRET / M651 / FLASHBANG

ACTUAL START TIME 1318
ACTUAL STOP TIME 1319

SHOOTER	WEAPON	MOVE TO POSITION	FERRET 1	FERRET 2	M651 1	M651 2	FLASH BANG 1	FLASH BANG 2	COMMENTS
Α	H&K MP-5 SUPPRESSED								
В	870 SHOTGUN								
С	H&K MP-5								
D	M-16								
Е	CAR-15								
F	9MM BROWNING								
G	M-60								
Н	MK-19								
I	M-79								

SEQUENCE 5: CEV UNCOVERS DEBRIS UNDER CHASSIS

ACTUAL START TIME 1319
ACTUAL STOP TIME 1320

	VEHICLE	MOVE FORWARD	EXPOSE DEBRIS	MOVE BACK	COMMENTS
ſ	CEV				

NIGHT STALKER - SERIES 2 - HEIGHT 6000 FT AGL

PLANNED START TIME ACTUAL START TIME 1333
PLANNED STOP TIME ACTUAL STOP TIME 1350

Temperature on site 67F Test fire M60 1325 & 1326

SEQUENCE 1: 5 ROUNDS SINGLE SHOT

ACTUAL START TIME 1333
ACTUAL STOP TIME 1336

SHOOTER	WEAPON	MOVE TO POSITION	ROUND 1	ROUND 2	ROUND 3	ROUND 4	ROUND 5	COMMENTS
Α	H&K MP-5 SUPPRESSED							
В	870 SHOTGUN							
С	H&K MP-5							
D	M-16							
E	CAR-15							
F	9MM BROWNING							
G	M-60							
Н	MK-19							
I	M-79							

SEQUENCE 2: 3 ROUNDS OF 3 SHOT BURSTS

ACTUAL START TIME 1337
ACTUAL STOP TIME 1342

SHOOTER	WEAPON	MOVE TO POSITION	ROUND 1	ROUND 2	ROUND 3	COMMENTS
Α	H&K MP-5 SUPPRESSED					
В	870 SHOTGUN					
С	H&K MP-5					
D	M-16					
E	CAR-15					
F	9MM BROWNING					Aborted round 1 jam on CAR-15
G	M-60					
Н	MK-19					
ı	M-79					

SEQUENCE 3: 3 ROUNDS OF FULL AUTOMATIC OR FLASHBANG

ACTUAL START TIME 1342
ACTUAL STOP TIME 1346

SHOOTER	WEAPON	MOVE TO POSITION	ROUND 1	ROUND 2	ROUND 3	COMMENTS
Α	H&K MP-5 SUPPRESSED					
В	870 SHOTGUN					
С	H&K MP-5					
D	M-16					
Е	CAR-15					
F	9MM BROWNING					
G	M-60					
Н	MK-19		•			
ı	M-79					

SEQUENCE 4: M-79 FERRET / M651 / FLASHBANG

ACTUAL START TIME 1348
ACTUAL STOP TIME 1349

							FLASH		
SHOOTER	WEAPON	MOVE TO POSITION	FERRET 1	FERRET 2	M651 1	M651 2	BANG 1	FLASH BANG 2	COMMENTS
Α	H&K MP-5 SUPPRESSED								
В	870 SHOTGUN								
С	H&K MP-5								
D	M-16								
E	CAR-15								
F	9MM BROWNING								
G	M-60								
Н	MK-19								
I	M-79								

SEQUENCE 5: CEV UNCOVERS DEBRIS UNDER CHASSIS

ACTUAL START TIME 1349
ACTUAL STOP TIME 1350

VEHIC	LE	MOVE FORWARD	EXPOSE DEBRIS	MOVE BACK	COMMENTS
CEV					

OFFICE OF SPECIAL COUNSEL INVESTIGATION VDS (UK) LOG OF DOCUMENTS RECEIVED

SERIAL	DATE RECEIVED	ITEM	QTY	OSC REF NO
1	19/12/99	DRAWINGS	2	Gp I, Pkt C, side views, all floors Gp I, Pkt D, first and second floor
2	19/12/99	DRAWINGS	2	plans
2	19/12/99	DRAWINGS	2	Gp I, Pkt C, side views, all floors
3			1	FLIR 26/3/93
4	04/01/00	VIDEO TAPE	1	
5	04/01/00	VIDEO TAPE		FLIR 19/4/93 VHS Qc1
6	04/01/00	VIDEO TAPE		FLIR 19/4/93 VHS Qc2
7	04/01/00	VIDEO TAPE	1	FLIR 19/4/93 VHS Qc3
8	04/01/00	VIDEO TAPE	1	FLIR 19/4/93 VHS Qc4
9	04/01/00	VIDEO TAPE		FLIR 19/4/93 NTSC Qc1
10	04/01/00	VIDEO TAPE	1	FLIR 19/4/93 NTSC Qc2
11	04/01/00	VIDEO TAPE	11	FLIR 19/4/93 NTSC Qc3
12	04/01/00	VIDEO TAPE	1	FLIR 19/4/93 NTSC Qc4
13	17/01/00	CD ROM	1	Col photos of 19/4/93
				DVD Clone of FLIR Footage. Ref
14	17/01/00	DVD	1	FVI WTX S/N1335 date 07/01/00 Memo from Mike Hesse - Timelin
52		D . 64		
15	17/01/00	Draft transcript	1	for 19/04/93 - draft transcript
		_		Dept of Justice FLIR capabilities
16	17/01/00	Report	1	report of 29/04/97
17	27-Jan-00	VIDEO TAPE1	1	Major network News Footage
18	27-Jan-00	VIDEO TAPE2	1	Gunfire Footage
19	27-Jan-00	VIDEO TAPE3	1	Fire Footage
20	27-Jan-00	VIDEO TAPE4	1	Gas Footage
21	27-Jan-00	VIDEO TAPE5	1	FLIR Footage
22	27-Jan-00	VIDEO TAPE6	1	FLIR Footage
23	27-Jan-00	VIDEO TAPE7	1	FLIR Footage
24	27-Jan-00	CD ROM	1	"Photographs" Fire
25	27-Jan-00	CD ROM	1	"Photographs" Tactical
26	27-Jan-00	ZIP DRIVE	1	"Photographs" Fire
27	27-Jan-00	ZIP DRIVE	1	"Photographs" Tactical
28	11-Feb-00	Tech reports	3	OSC294-001 to 0100
				"Brad files - 39 items" Colour
29	18-Feb-00	CD ROM	2	ground shots
30	18-Feb-00	21 Page Text - hardcopy	1	Protocol US issued format
50	10 1 05 00	Zii ago iom marcop)		Enlargements of WACO Area
31	18-Feb-00	Colour Prints	3	Vertical images. (Nat Guard)
	01-Mar-00	CD-ROM	1	77 images at high res. FBI clour
32	10-Mar-00	report	1	Edward Allard final report
33			1	System Engineering report
34	10-Mar-00	report	1	Jack Zimmerman report
35	10-Mar-00	report		Ferdinand Zegel final report
36	10-Mar-00	report		Maurice Cox report
37	10-Mar-00	report		CTL (DOJ) report
38	10-Mar-00	report	1	
39	10-Mar-00	report	1	MADL Flash Analysis Report
			ž.	MADL IR Video Review - fire
40	10-Mar-00	Video	1	development
41	10-Mar-00	report	1	MADL Solar spec reflections
42	10-Mar-00	Video	1	MADL Solar spec refl - Far IR
43	10-Mar-00	Report	1	Final rept Irving W Ginsberg
44	10-Mar-00	Report	1	MADL Muzzle flash detection
				Mensuration images Bitmap 1200
45	13-Mar-00	CD ROM	7	dpi ROMs 2-8 incl.
46	13-Mar-00	Video	1	FBI - Glint Dallas Apr 97
47	13-Mar-00	Video	1	FBI - Lab Horseshoe Bay Texas
48	13-Mar-00	Video	1	FBI Nightstalker FLIR examples

OFFICE OF SPECIAL COUNSEL INVESTIGATION

VDS (UK) LOG OF DOCUMENTS RECEIVED

CEDIAL	DATE DECEIVED	ITEM	OTV	OSC REF NO
	DATE RECEIVED		QTY	
49	14-Mar-00	CD ROM	2	1200 dpi scans (9 images)
50	16-Mar-00	CD-ROM	12	150 - 1200 dpi scans
51	16-Mar-00	Floppy (damaged)	1	FLIR presentation
52	24-Mar-00	Computer Hard Drive	1	Trial Imagery
53	27-Mar-00	MET Reports	2	MET Reports for 18-19 Mar 00
54	03-Apr-00	Photo List	13	Large Photos
55	03-Apr-00	Photo List	855	Photos (Colour and B/W)
56	03-Apr-00	CD ROM dated 3/29/00	1	VDS Photos
57	03-Apr-00	Hi-8 Video Tape Lynx 1	1	FLIR Trial Video
58	03-Apr-00	Hi-8 Video Tape Lynx 2	1	FLIR Trial Video
59	03-Apr-00	NTSC Video Tape Lynx 1	1	FLIR Trial Video
60	03-Apr-00	NTSC Video Tape Lynx 2	1	FLIR Trial Video
61	03-Apr-00	NTSC Video Tape NS-1	1	FLIR Trial Video
62	04-Apr-00	Photographs of Trial Debris field	71	
63	06-Apr-00	Ground video of FLIR Trial	1	989-1298777 Lab No AV 9689
64	06-Apr-00	Ground video of FLIR Trial	1	989-1298777 Lab No AV 9689
65	06-Apr-00	Ground video of FLIR Trial	1	989-1298777 Lab No AV 9689
66	06-Apr-00	Ground video of FLIR Trial	1	989-1298777 Lab No AV 9689
67	06-Apr-00	Ground video of FLIR Trial	1	989-1298777 Lab No AV 9689
68	06-Apr-00	Ground video of FLIR Trial	1	989-1298777 Lab No AV 9689
69	08-Apr-00	CD ROM	1	Thermacam images of FLIR Trial
70	10-Apr-00	35mm slides	3	FBI slides 19/4/93 - 1030-1230
71	10-Apr-00	colour computer printout	10	FBI colour images 19//4/93
72	10-Apr-00	Colour Prints	1	FBI colour images 19//4/94

Mensuration Report for the Analysis of Mount Carmel Compound

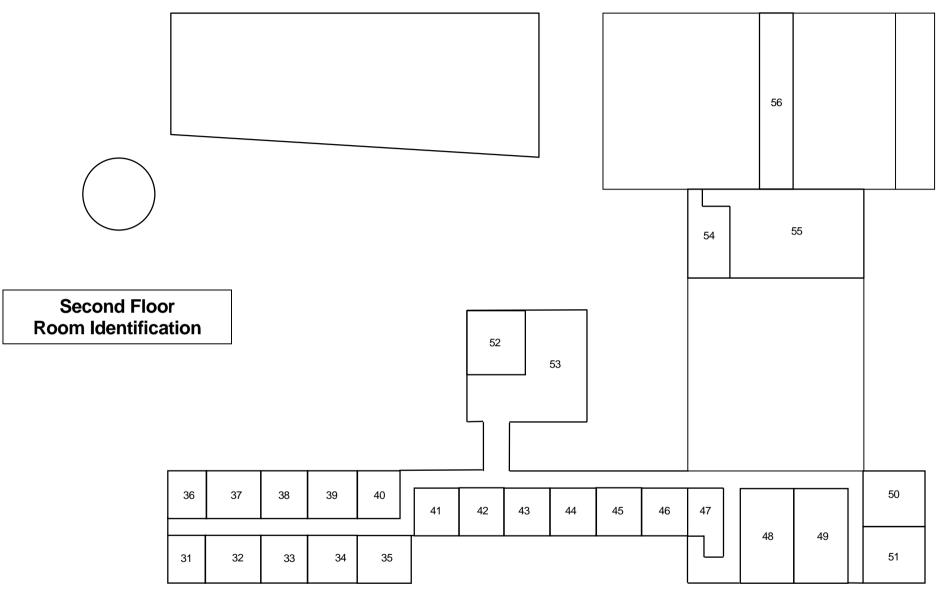
- i. Vector Data Systems (UK) Ltd were requested by the Office of Special Counsel to produce a comprehensive set of measurements of the Mount Carmel compound in order to support their work to investigate the events that occurred there on 19th April 1993. VDS were provided the imagery necessary for the task, the main aim of which was to produce as precise a model of the compound as possible, from the collateral supplied. The work involved measuring not only the size of the component building structures but also the size and positions of the window apertures. In order to visually check the resultant dimensions, a three-dimensional Computer Aided Design model was produced. This model was then compared with many other views of the compound, some of which would not necessarily be directly suitable for the mensuration task.
- 1. The optical collateral used for the purpose of mensuration was of reasonable quality, being high-resolution (typically 1200-dpi) scan digitised imagery. The majority of the imagery was low-oblique, long slant range, hand held photography. Supplemental to this imagery was close range, hand held photography taken from various vantagepoints on the ground.
- 2. Further supplementary collateral was captured from the thermal infrared video imagery. Whilst neither the geometry of the imagery capture, nor the proportionality of the recorded image is not known precisely, imagery pixels were assumed to be able to be linearly calibrated in screen-X or screen-Y directions where near-vertical imagery was observed. This further imagery was required at the time the mensuration task was performed since much of the high quality imagery, subsequently available, was not initially provided.
- 3. The origins of the imagery are unknown. Nothing is known about the camera system used to capture the imagery. The original negatives were unavailable. Since no interior or exterior orientation could be performed, the methods of classical photogrammetry were not possible for this task.
- 4. Since these images were all taken from a reasonably long standoff position, it can be assumed long focal length lenses were used. This would have the effect of reducing radial distortion toward the edges of the frames.
- 5. The method used for mensuration was by direct comparison of unknown dimensions with dimensions of known objects namely the various military vehicles, which were observed in the frames of imagery, or previously measured aspects of the compound. The dimensions of the objects used were as follows:

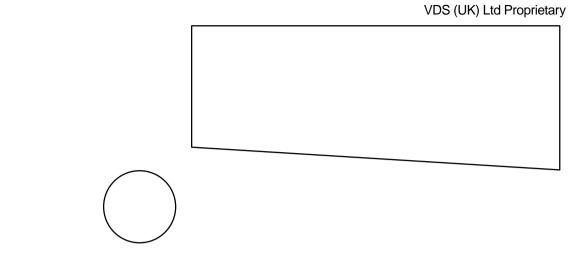
Vehicle	Length (m)	Width (m)
M-728 Combat Engineer Vehicle	6.976	3.631
M-88 Armoured Recovery Vehicle	8.255	3.429
M-2 Infantry Fighting Vehicle (Bradley)	6.55	3.61

- 6. Complications arose from the obliquity of the aerial imagery, which results in a scale change throughout the images. This problem was overcome to some degree for horizontal distances by the availability of imagery from many angles around the compound and the piecewise movement of the calibration objects the military vehicles throughout the period that the imagery was captured. Wherever such imagery was available, vehicles were measured whilst in the same object plane as the dimension to be measured, but this was not possible in all cases.
- 7. Observations were noted in a spreadsheet which recorded the x and y pixel positions of the observed points. A 'pixel-distance' was calculated using Pythagorus and a 'pixel-gradient' was calculated to keep a check on alignments of calibration objects and the distances to be measured. This is an important factor, since in the best case, calibration objects should not only lie in the same plane as the object to be measured, but the calibration dimension should be near parallel to the object dimension also.
- 8. No height information was gained directly from the oblique imagery since no calibration dimensions could be observed. Although the heights of the military vehicles are known, the obliquity of the aerial imagery made direct comparisons impossible.
- 9. Heighting of the compound and its component fabric was initially carried out by reference to the outside door at the back of the dining area. In this part of the compound, the walls are faced with horizontal 'shiplap' type panelling. It was possible to calibrate the height of these panels and then to count the number of panels making up the major parts of the compound structure. Windows that were not measurable in this way were sized by proportional reference to the previously calculated overall height of the building structure in which they were mounted.
- 10. The error statement is drawn from comparison of multiple measurements of a common object from all types of collateral and from different frames of the optical imagery. On the oblique imagery, both walls and roofs could be measured. Only the roof dimensions could be compared with the near-vertical capture, however. Error tolerances are not quoted for each individual dimension since in many cases they could only be measured once, but clearly the absolute error will be larger for greater dimensions. It is assumed that the systematic error introduced by the imaging process – capture angles, photographic equipment, photographic materials, photographic reproduction, and scanning - will be greater than the random error introduced by observing pixels on the screen. This assumption is supported in that, whether measuring small objects such as windows or large objects such as building facades, consistently repeatable observations could be made. The object distance represented by one image pixel was therefore very much less than the overall error quoted. A general error of ± 0.2 m (± 8 inches) is quoted to give an impression of the overall accuracy of the dimensions given. Although some observed dimensions fall out of this error bound, it is considered that a weighted error should be applied to the calculated dimensions with emphasis given to those that best fit the plane and alignment of the calibration objects.
- 11. A total of 19 images were used collectively for mensuration of the Mount Carmel compound.

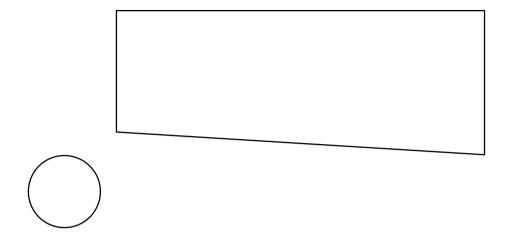


Not to Scale



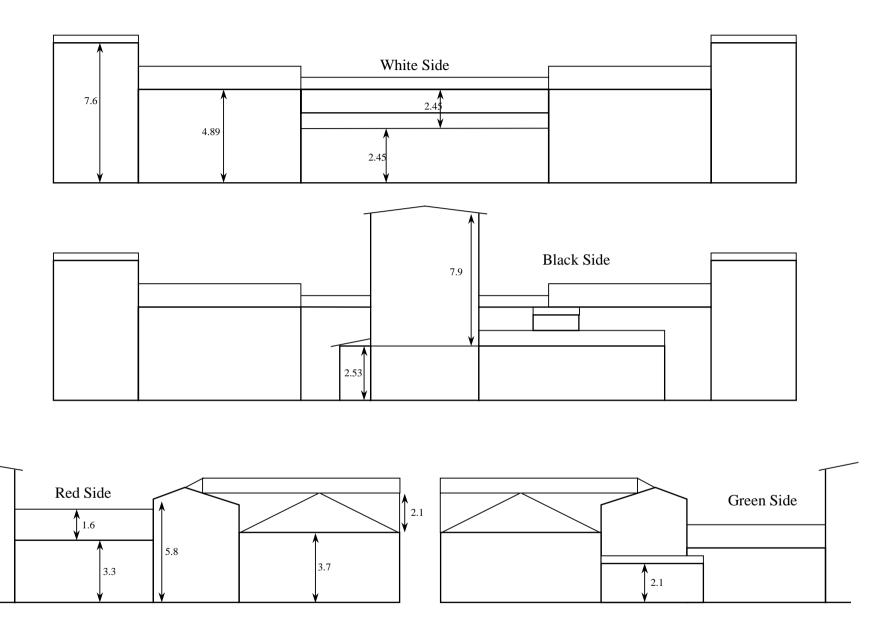


Third Floor Room Identification



Fourth Floor Room Identification

60



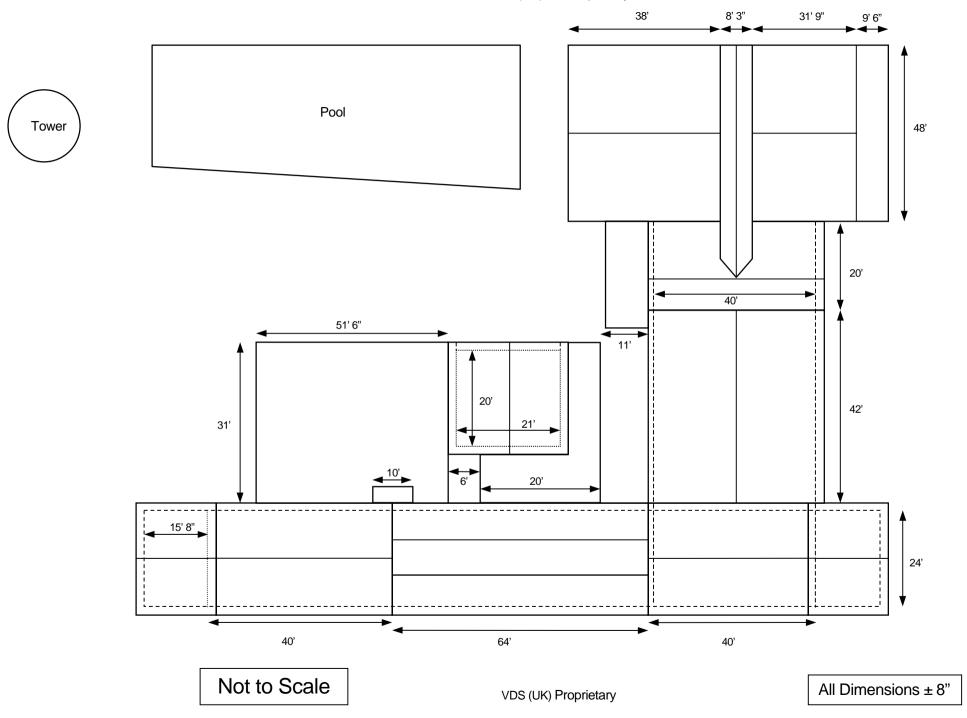


Image Numbe	r 6-21													
						Pixel	Calibration Distance	Object Distance	Pixel Gradient	t	Object Distance			
Calibration Object CEV Width	Pixel Count	x1 3267	y1 2623	x2 3481	y2 2644	Distance 215.028	(m)	(m)	(deg)		(ft)			
Building Side White							3.631	0.0168862	-5.605					
	Centre Block R	1986 3130	2315 2255	3134 3851	2370 2283	1149.317 721.543		19.41 12.18	-2.743 -2.224		63.7			
	Tower R	3851	2283	4140	2294	289.209		4.88	-2.224		40.0 16.0			
	Frontage	972	2363	4141	2503	3172.091		53.56	-2.530		175.7			
Image Number	6-26													
						Pixel	Calibration Distance	Object Distance	Pixel Gradient		Object Distance			
Calibration Object	Pixel Count	x1	y1	x2	y2	Distance	(m)	(m)	(deg)		(ft)			
CEV Length (Gym)		5211	2760	5599	2793	389.401	6.976	0.0179147	-4.861		, ,			
CEV Length Bradley Width		1964 952	2525 2706	2315 1124	2588 2706	356.609 172.000	6.976 3.61	0.019562 0.0209884	-10.176 0.000					
							3.01							
Building Side Red	Tower Chapel	2773 3246	2744 2753	3191 3963	2775 2806	419.148		7.51	-4.241		24.6			
Neu	Block	3963	2806	4310	2816	718.956 347.144		12.88 6.22	-4.228 -1.651		42.3 20.4			
	Gym	4243	3064	5089	3128	848.417		15.20	-4.326		49.9			
	Walkway	4235	2541	5190	2608	957.347		17.15	-4.013		56.3			
Image Number	6-15													
						Pixel	Calibration Distance	Object Distance	Pixel Gradient		Object Distance			
Calibration Object	Pixel Count	x1	y1	x2	y2	Distance	(m)	(m)	(deg)	•	(ft)			
CEV Length		1242	3210	1647	3126	413.619	6.976	0.0168657	11.717		(/			
Building Side Red	Red Tower Chapel	2349	3663	2796	3615	449.570		7.58	6.129	Enlarged Not measurable	24.9			
	Block	3530	3460	3899	3430	370.218		6.24	4.648		20.5	Corrected	6.08	19.9
	Gym Main Tower	3979 2805	3723 2934	4870 3165	3656 2907	893.516 361.011		15.07 6.09	4.300 4.289	In plane of CEV	49.4 20.0	Corrected	14.67	48.1
	Green Tower	1979	2023	2403	1986	425.611		7.18	4.987	III plane of OLV	23.6	Corrected	7.38	24.2

Image Number	6-1										
						Pixel	Calibration Distance	Object	Pixel Gradient		Object
Calibration Object	Pixel Count	x1	y1	x2	y2	Distance	(m)	Distance (m)	(deg)		Distance (ft)
CEV Width		3339	2628	3517	2649	179.234	3.631	0.0202584	-6.729		(11)
	Gym Flat Section	2333	2224	2476	2235	143.422		2.91	-4.399		9.5
Building Side	Gym Left	2476	2235	2953	2277	478.845		9.70	-5.032		31.8
Black] Walkway	2964	2166	3090	2183	127.142		2.58	-7.684		8.5
	Chapel Width	2809	1844	3399	1882	591.222		11.98	-3.685		39.3
•	Main Tower	3771	1722	4083	1754	313.637		6.35	-5.856		20.8
	Cooler	3683	1752	3767	1751	84.006		1.70	0.682		5.6
	Café	4083	1785	4856	1854	776.073		15.72	-5.101		51.6
	Café Roof Stairwell	4334	1539	4480	1554	146.769		2.97	-5.866		9.8
	Tower Red	5018	1498	5247	1526	230.705		4.67	-6.971		15.3
Image Number	5-25	Medium	Obliqu	е							
						D'	Calibration	Object	Pixel		Object
Calibration Object	Pixel Count	x1	4		0	Pixel	Distance	Distance	Gradient		Distance
CEV Width	Pixel Count	4012	y1 3343	x2	y2	Distance	(m)	(m)	(deg)		(ft)
CEV WIQUI		4012	3343	4240	3361	228.709	3.631	0.015876	-4.514		
Building Side	Tower L	2470	3007	2764	3014	294.083		4.67	-1.364		15.3
White	Block L	2764	3072	3546	3104	782.654		12.43	-2.343		40.8
	Centre	3552	3227	4793	3297	1242.973		19.73	-3.228		64.7
	Block R	4793	3177	5582	3214	789.867		12.54	-2.685		41.1
	Tower R	5581	3156	5899	3170	318.308		5.05	-2.521		16.6
	Main Tower (top)	4017	2664	4427	2693	411.024		6.53	-4.046		21.4
	Chapel (length)	4922	2442	5697	2466	775.372		12.31	-1.774		40.4
	Frontage	2470	3263	5901	3452	3436.202		54.55	-3.153	Cross Check	179.0
								Printed and the second and the second		(sum of parts)	
										54.4	2
Image Number	FBI0650080	Low obl	ique								
							Calibration	Object	Pixel		Object
						Pixel	Distance	Distance	Gradient		Distance
Calibration Object	Pixel Count	x1	y1	x2	y2	Distance	(m)	(m)	(deg)	Notes	(ft)
Tower		114	1802	666	1804	552.004	7.38	0.0133695	-0.208		24.2
Main Tower	1	922	1264	1365	1259	443.028	6.09	0.0137463	0.647		20.0
Building Side	Chapel	662	1678	1632	1667	970.062		12.97	0.650		42.4
Red	Block	1634	1547	2093	1585	460.570		6.16	-4.733		
	Gym .	2103	2052	3220	2061	1117.036		14.93	-0.462		48.8
	Walkway to Tower	670	1070	924	1069	254.002		3.49	0.226		
	Café Depth	669	1362	1364	1371	695.058		9.55	-0.742		

MOUNT CARMEL COMPOUND

Image Number	FBI0650078	Low obl	ique				Calibration	Object	Pixel		Object
Calibration Object Walkway	Pixel Count	x1 1213	y1 1535	x2 1432	y2 1532	Pixel Distance 219.021	Distance (m) 2.5	Distance (m) 0.0114145	Gradient (deg) 0.785	Notes	Distance (ft) 0.0
Building Side	Gym 'Flat'	150	1748	391	1747	241.002		2.75	0.238		9.0
Black	Gym Left	391	1747	1224	1744	833.005		9.51	0.206		31.2
	Gym Right	1428	1742	2462	1731	1034.059		11.80	0.610		38.7
Gymnasium Windows	Window Width 1	557	1851	606	1853	49.041		0.56	-2.337		1.8
	Window Spacing 1	606	1853	707	1850	101.045		1.15	1.701		3.8
	Window Width 1	707	1850	763	1850	56.000		0.64	0.000		2.1
	Window Spacing 2	763	1850	865	1848	102.020		1.16	1.123		3.8
	Window Width 2	865	1848	917	1847	52.010		0.59	1.102		1.9
	Window Spacing 3	917	1847	1019	1846	102.005		1.16	0.562		3.8
	Window Width 3	1019	1846	1071	1847	52.010		0.59	-1.102		1.9
	Window Spacing 4	1071	1847	1172	1846	101.005		1.15	0.567		3.8
	Window Width 4	1172	1846	1226	1845	54.009		0.62	1.061		2.0
	Window Spacing 5	1226	1845	1329	1844	103.005		1.18	0.556		3.9
	Window Width 5	1329	1844	1381	1844	52.000		0.59	0.000		1.9
	Window Spacing 6	1381	1844	1483	1843	102.005		1.16	0.562		3.8
	Window Width 6	1483	1843	1533	1845	50.040		0.57	-2.291		1.9
	Window Spacing 7	1533	1845	1639	1845	106.000		1.21	0.000		4.0
	Window Width 7	1639	1845	1689	1846	50.010		0.57	-1.146		1.9
	Window Spacing 8	1691	1846	1792	1843	101.045		1.15	1.701		3.8
	Window Width 8	1792	1843	1842	1843	50.000		0.57	0.000		1.9
	Window Spacing 9	1842	1843	1946	1842	104.005		1.19	0.551		3.9
	Window Width 9	1946	1842	1997	1841	51.010		0.58	1.123		1.9
	Window Spacing 10	1997	1841	2101	1843	104.019		1.19	-1.102		3.9
	Window Width 10	2101	1843	2151	1838	50.249		0.57	5.711		1.9
	Window Spacing 11	2151	1838	2253	1837	102.005		1.16	0.562		3.8
	Window Width 11	2253	1837	2302	1837	49.000		0.56	0.000		1.8
	Walkway Window	1293	1620	1360	1620	67.000		0.76	0.000		2.5

Image Number	FBI0650078	Low ob	lique				Calibration	Object	Pixel		Object
						Pixel	Distance	Distance	Gradient		Distance
Calibration Object	Pixel Count	x1	y1	x2	y2	Distance	(m)	(m)	(deg)	Notes	(ft)
White Frontage		547	949	4809	918	4262.113	53.56	0.0125665	0.417	, , , , , ,	175.7
Building Side	Upper Window 1	2087	992	2141	995	54.083		0.68	-3.180		2.2
Black	Lower Window 1	2087	1153	2143	1151	56.036		0.70	2.045		2.3
	Lean-to	3475	1034	3534	1034	59.000		0.74	0.000		2.4
	Window 2	3627	982	3679	983	52.010		0.65	-1.102		2.1
	Window Spacing	3679	983	3869	979	190.042		2.39	1.206		7.8
	Window 3	3869	979	3924	981	55.036		0.69	-2.083		2.3
	Window Spacing	3924	981	4161	980	237.002		2.98	0.242		9.8
	Window 4	4161	980	4213	980	52.000		0.65	0.000		2.1
	Window Spacing	4213	980	4450	955	238.315		2.99	6.022		9.8
	Window 5	4450	955	4506	955	56.000		0.70	0.000		2.3
Image Number	FBI0650080	Low obl	ique								
							Calibration	Object	Pixel		Object
						Pixel	Distance	Distance	Gradient		Distance
Calibration Object	Pixel Count	x1	y1	x2	y2	Distance	(m)	(m)	(deg)	Notes	(ft)
Red Tower		113	1801	666	1804	553.008	7.38	0.0133452	-0.311		24.2
Main Tower (bottom)		925	1141	1368	1143	443.005	6.09	0.013747	-0.259		20.0
Main Tower (top)		925	762	1373	762	448.000	6.09	0.0135938	0.000		20.0
Building Side	Upper Window 1	220	1531	267	1531	47.000		0.63	0.000		2.1
Red	Middle Window 1	217	1708	266	1710	49.041		0.65	-2.337		2.1
	Lower Window 1	213	1851	269	1855	56.143		0.75	-4.086		2.5
	Upper Window Spacing	267	1531	509	1534	242.019		3.23	-0.710		10.6
	Upper Window 2	509	1534	556	1533	47.011		0.63	1.219		2.1
	Middle Window Spacing	266	1710	508	1667	245.791		3.28	10.075		10.8
	Middle Window 2	508	1667	555	1668	47.011		0.63	-1.219		2.1
	Lower Window Spacing	269	1855	504	1858	235.019		3.14	-0.731		10.3
	Lower Window 2	504	1858	561	1856	57.035		0.76	2.010		2.5
	Chapel Window 1	860	1737	917	1737	57.000		0.76	0.000		2.5
	Window Spacing	917	1737	1135	1735	218.009		2.91	0.526		9.5
	Chapel Window 2	1135	1735	1191	1713	60.166		0.80	21.448		2.6
	Window Spacing	1191	1735	1408	1735	217.000		2.90	0.000		9.5
	Chapel Window 3	1408	1712	1465	1714	57.035		0.76	-2.010		2.5
	Window Spacing	1465	1714	1678	1721	213.115		2.84	-1.882		9.3
	Lower Window	1678	1721	1741	1723	63.032		0.84	-1.818		2.8
	Double Window L	1747	1567	1807	1569	60.033		0.80	-1.909		2.6
	Double Window R	1822	1568	1880	1569	58.009		0.77	-0.988		2.5
	Upper Tower Window	1014	835	1064	839	50.160		0.68	-4.574		2.2
	Middle Tower Window	1231	1007	1279	1008	48.010		0.66	-1.193		2.2
	Lower Tower Window	1014	1191	1062	1189	48.042		0.66	2.386		2.2

Image Number	4476 + Various										
						Discol	Oalibaatiaa	Object		Pixel	
Outilization Object	Discal Count	4	4			Pixel	Calibration	Distance		Gradient	
Calibration Object	Pixel Count	x1 76	y1 95	x2 523	y2 91	447.018	Distance (m) 12	(m)		(deg) 0.513	
Duilding Cide	Block R Width	76	95	525	91	447.010	12	0.026845		0.515	
Building Side	Disale D. Haimht	372	270	375	79	191.024		5.13		89.100	
White	Block R Height Central Block Base	76	269	79	168	101.024		2.71		88.299	
	Central Block Upper storey	79	168	76	76	92.049		2.47		-88.132	
	Central block Opper storey	, 79	100	70	,0	32.043		2.71	SATAS CARE	-00.102	
Image Number	4358										
illage Nulliber	4000							Object	Object	Pixel	
		Number of				Pixel	Calibration	Distance	Distance	Gradient	
Calibration Object	Pixel Count	Planks				Distance	Distance (m)	(m)	(ft)	(deg)	Notes
	Panelled Door on Café					0.000	1.98	, ,		(0)	Assumed to be a 6' 6" door
Using Shiplap Planks	Shiplap Panel						0.18094				11 panels to height of door
	Café Frontage	14						2.53	8.31		
	Main Tower	44						7.96	26.12		Height above Bunker
	Outhouse	13						2.35	7.72		
	Café Roof	4						0.72	2.37		
	Passage to Tower	14						2.53	8.31		
	Extension over Café	7						1.27	4.16		
	Accom Block	27						4.89	16.03		
	Red Tower	42						7.60	24.93		
	4050										
Image Number	4358							Object		Pixel	
						Pixel	Calibration	Distance		Gradient	
	Pixel Count	x1	y1	x2	y2	Distance				(deg)	Notes
Calibration Object	Block R Height	156	224	159	103	121.037	5.13	0.042367		88.580	110103
Building Side		.50		.00	.00		5.10	0.0 .2007		55.000	
White	Red Tower	268	225	267	43	182.003		7.71			
								-			

All linear dimensions in FEET.

All dimensions are exterior
Wall thicknesses have been neglected

irst Floor

Men's quarters

Room
Breadth (ft)
Depth (ft)
Area (sq ft)
Height (ft)
olume (cubic feet)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	 		55.77				48	3	3	9.5	16	16	16	16
			24				9	4.5	4.5	9	9	9	9	9
			1338.48				432	13.5	13.5	85.5 .	144	144	144	144
			8				8	8	8	8	8	8	8	8
			10707.84				3456	108	108	684	1152	1152	1152	1152

Room
Breadth (ft)
Depth (ft)
Area (sq ft)
Height (ft)
Volume (cubic feet)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Foyer/Lounge/Corridor
	17	17	16	16	40	10	40	26	48	9.5	51.5	20	14	20	21	40
L	9	9	9	14.9	42	6	20	10	78	48	31	21	6	6	11	15
L	153	153	144	298.4	1680	60	740	260	3744	456	1596.5	336	84	120	231	1137
	8	8	8	8	10.8	8.8	8.8	6.7	12	8	8	8	8	8	8	8
	1224	1224	1152	2387.2	18144	528	6512	1742	44928	3648	12772	2688	672	960	1848	9096

otal Volume

19671.84 cubic feet

728.5867 cubic yards

econd Floor

Women's Quarters

Room
Breadth (ft)
Depth (ft)
Area (sq ft)
Height (ft)
Volume (cubic fee

					_		-							
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
9.77	11.5	11.5	11.5	11.5	9.77	11.5	11.5	11.5	7.5	10.5	10.5	10.5	10.5	10.5
9	9	9	9	9	9	9	9	9	9	8	8	8	8	8
87.93	103.5	103.5	103.5	103.5	87.93	103.5	103.5	103.5	67.5	84	84	84	84	84
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
703.44	828	828	828	828	703.44	828	828	828	540	672	672	672	672	672

Room
Breadth (ft)
Depth (ft)
Area (sq ft)
Height (ft)
Volume (cubic feet)

46	47	48	49	50	51	52	53	54	55	56	Corridors
10.5	9	20	20	12	12	10	20	16	20	48	178
8	8	12	12	16	16	10	21	10	30	8.25	5
104	72	240	240	192	192	100	320	176	600	396	890
8	8	8	8	8	8	8	8	8	8	8.5	8
832	576	1920	1920	1536	1536	800	2560	1408	4800	3366	7120

otal Volume

11102.88 cubic feet

411.2178 cubic yards

hird Floor We

Women's Quarters

Room
Breadth (ft)
Depth (ft)
Height (ft)
Volume (cubic feet)

	57	58	59
	20	24	24
	21	15.75	15.75
	8	8	8
) [3360	3024	3024

otal Volume

9408 cubic feet

348.4444 cubic yards

ourth Floor

David Koresh's Quarters

Total Volume

3360 cubic feet

124.4444 cubic yards

Room Breadth (ft) Depth (ft) Height (ft) Volume (cubic feet)

Total Volume

43543 cubic feet

1612.7 cubic yards

- 1. These areas/volumes are estimated using the floorplan laid out by previous testament and are not supplied solely by VDS (UK) Ltd
- 2. The room volumes are calculated without roofspace.
- 3. Not all voids and stairwells have been included.

lotes

Image Number	650077									
						Dival	0-1:1	Object	Pixel	
	Pixel Count	x1	y1	x2	y2	Pixel Distance	Calibration Distance (m)	Distance	Gradient	Mataa
Calibration Object	Red Tower Height	486	783	485	698	85.006	7.71	(m) 0.09071	(deg) -89.326	Notes
Building Side	7	100	700	100	000	00.000	7.71	0.03071	-03.520	
Red	Chapel Height	706	766	705	730	36.014		3.27		
	Block R	706	766	705	702	64.008		5.81		
	Gym Height	935	790	934	749	41.012		3.72		
Image Number	650078									
								Object	Pixel	
						Pixel	Calibration	Distance	Gradient	
	Pixel Count	x1	y1	x2	y2	Distance	Distance (m)	(m)	(deg)	Notes
Calibration Object	_Gym Height	335	642	334	601	41.012	3.72	0.09071	-1.546	
Building Side										
Red	Walkway Height	334	601	334	578	23.000		2.09		
	Main Tower	552	575	551	469	106.005		9.62		For comparison
	Red Tower	251	550	249	473	77.026		6.99		
	Walkway Roof Pitch	347	577	347	565	12.000		1.09		
Image Number	4476									
								Object	Pixel	
0 - 1'1 1' 0 - 1 1	5: 10					Pixel	Calibration	Distance	Gradient	
Calibration Object	Pixel Count	x1	y1	x2	y2	Distance	Distance (m)	(m)	(deg)	
Duibling Oids	Block R Width	73	95	521	92	448.010	12	0.026785	0.384	
Building Side	With the Book	-								
White	Kitchen Roof	73	166	74	131	35.014		0.94	88.363	
	Kitchen Upper Roof	74	81	73	53	28.018		0.75	-87.955	
	Block R Roof	521	75	520	31	44.011		1.18	-88.698	
Tower	10 Shiplap Planks	333	21			333.6615		1.8094		
		810	41			811.037		4.398141		
		477	27			477.7635		2.53316		
								1.69757		

image Number	FBI-OSC-00002801									
Calibration Object	Pixel Count Tower Height	x1 1179	y1 2814	x2 1122	y2 1226	Pixel Distance 1589.023		Object Distance (ft) 0.01643		Notes
Building Side					1220	1000.020	20.1	1 0.01040		
Black	Tower Base Window	310	2661	301	2410	251.161		4.13	4' 1"	
	Height from Base	310	2837					2.89	2' 11"	
Main Tower	Tower Middle Window Height from Base	886	2105	875	1854	251.241		4.13 11.65	4' 1" 11' 8"	
	Tower Upper Window	264	1579	259	1329	250.050		4.11	4' 1"	
	Height from Base	310	2837					20.66	20' 8"	
Accomodation Block	Stairwell	3215	2587	3204	2438	149.405		2.45	2' 5"	
	Bridge to Tower	1782	2570	1778	2426	144.056		2.37	2' 4"	
	Accomodation Corridor Left	3616	2513	3616	2364	149,000		2.45	2' 5"	
	Accomodation Corridor Middle	4162	2497	4156	2348	149.121		2.45	2' 5"	
	Accomodation Corridor Right	4832	2486	4828	2335	151.053		2.48	2' 5"	
mage Number	FBI0650080									
						Pixel	Calibration Distance	Object Distance		
Calibration Object	Pixel Count	x1	y1	x2	y2	Distance	(ft)	(ft)		
	Tower Height	439	2306	442	1730	576.008	26.1	0.04531		
Building Side								•		
Red	Tower Lower Left Window	555	2227	556	2138	89.006		4.03		
	Tower Lower Right Window	833	2223	834	2134	89.006		4.03		
White/Red Tower	Base Height							3.76	3' 9"	Height of base of window
	Tower Middle Left Window	550	2041	556	1951	90.200		4.09		
	Tower Middle Right Window	847	2037	847	1946	91.000		4.12		
	Base Height							12.19	12' 2"	Height of base of window
	Tower Upper Left Window	549	1862	554	1773	89.140		4.04		
	Tower Upper Right Window Base Height	845	1857	844	1769	88.006		3.99 20.12	20' 1"	Height of base of window
								TOTAL PROPERTY AND ASSESSED FOR STREET		. loight of bacc of willdow
							Average height	4.05	4'	

Note. Due to the scale of the image, all windows can be assumed to be of equal height.

					WIN	IDOWS Pixel	Calibration Distance	Object Distance	
Calibration Object	Pixel Count	x1	y1	x2	y2	Distance		(ft)	
	_Stage/Gunroom	2018	2190	2018	1761	429.000	19	0.04429	
Building Side								_	
Red	Chapel Window	2026	2109	2023	1971	138.033		6.11	6' 1"
Chapel	Height from Base Upper Window	2093	1873	2084	1704	00.454		3.59	3' 7"
Onaper	Height from Base	2093	10/3	2004	1784	89.454		3.96 14.04	4' 14'
	rieigin mein zaee							14.04	144
Image Number	FBI1050792								
								Object	
Calibration Object	Pixel Count	v4	ud	v2		Pixel	Calibration Distance	Distance	
Calibration Object	Right Block	x1	y1	x2	y2	Distance	(ft)	(ft)	
Building Side	Night Block	1148	575	1150	143	432.005	24.9	0.05764	
White	Middle Left Upper Window	819	388	819	321	67.000		3.86	3' 10"
	Height from Base	819	570	0.0	02.	01.000		10.49	10' 6"
	Left Upper Window	657	386	657	319	67.000		3.86	3' 10"
Right Block	Middle Right Upper	984	388	984	321	67.000		3.86	3' 10"
	Right Upper	1183	388	1183	320	68.000		3.92	3' 11"
	Left Lower Height from Base	653 651	523	653	457	66.000		3.80	3' 10"
	Right Lower	982	567 526	982	460	66.000		2.54	2' 6" 3' 10"
	Height from Base	302	520	302	400	00.000		3.80	3 10
								618C2206CU(2)816G6C6SU	
Central Section	Middle Right Lower Window	89	518	91	451	67.030		3.86	3' 10"
	Height from Base	90	564					2.65	2' 8"
	Right Lower Window	344	522	346	455	67.030		3.86	3' 10"
	Height from Base	342	566					2.54	2' 6"
	Right Upper Window	441	368	440	332	36.014		2.08	2' 1"
	2nd Right	281	368	282	332	36.014		2.08	2' 1"
								CONSTRUCTION OF THE PARTY OF TH	
Image Number	FBI1050792								
mage Number	FB11050792							Ohioot	
						Pixel	Calibration Distance	Object Distance	
Calibration Object	Pixel Count	x1	y1	x2	y2	Distance	(ft)	(ft)	
	Gym Height	1124	800	1116	475	325.098	12.1	0.03722	
Building Side									
Black	Leftmost Window	469	605	467	544	61.033		2.27	2' 3"
	Height from Base	471	804	1000				7.41	7' 5"
Gym	5th from left Window Height from Base	1085 1085	598 800	1086	539	59.008		2.20	2' 2"
· ,	Rightmost Window	2167	590	2163	529	1348.045 61.131		7.52 2.28	7' 6" 2' 3"
	Height from Base	2163	792	2.100	020	2303.439		7.52	7' 6"
								articular and the same of the	. 0
	Walkway Window	1213	373	1211	308	65.031		2.42	2' 5"
	Height from Base	1213	800			1453.055		15.89	15' 11"

BUILDING VOLUMES

26.6

25.4

16.5

8.5

8.5

16.5

25.4

11.3

19.5

7.4

12.6

2.6

8.7

8.5

4.7

Volume

(cubic feet)

11724.0

10112.4

16372.1

13432.1

9046.1

16372.1

10112.4

19450.1

16189.9

2170.1

53043.5

1097.1

21375.9

1006.8

314.7

187987.4

27115.3

Error Calculation Maximum Volume

20.5

16.25

40.5

64.5

64.5

40.5

16.25

42.5

20.5

25.5

86.8

8.7

78

11.5

10.3

Width (ft) Depth (ft) Height (ft)

21.5

24.5

24.5

24.5

16.5

24.5

24.5

40.5

40.5

11.5

48.5

48.5

31.5

10.3

	Calculated Vo	olume		
				Volume
Mainspace	Width (ft)	Depth (ft)	Height (ft)	(cubic feet)
Main Tower	20	21	26.1	10962.0
Tower L	15.75	24	24.9	9412.2
Block L	40	24	16	15360.0
Accomodation Lower Floor	64	24	8	12288.0
Accomodation Upper Floor	64	16	8	8192.0
Block R	40	24	16	15360.0
Tower R	15.75	24	24.9	9412.2
Chapel	42	40	10.8	18144.0
Bedroom/Gunroom	20	40	19	15200.0
Lean-to	25	11	6.9	1897.5
Gym	86.3	48	12.1	50123.0
Walkway	8.2	48	2.1	826.6
Café and Tower Base	77.5	31	8.2	19700.5
Passage to Tower	11	9.8	8	862.4
Stairwell over Café	9.8	6	4.2	247.0
		Volume		187987.4
				Volume
Roofspace	Width (ft)	Depth (ft)	Height (ft)	(cubic feet)
Main Tower	20	21	1	210.0
Tower L	15.75	24	1	189.0
Block L	40	24	1	480.0
Accomodation Lower Floor	64	24	3.3	2534.4
Accomodation Upper Floor	64	16	3	1536.0
Block R	40	24	4	1920.0
Tower R	15.75	24	1	189.0
Chapel	42	40	5.3	4452.0
Stage/Bedroom	20	40	3.3	1320.0
Lean-to	25	11	1.6	220.0
Gym R	31.8	48	6.9	5266.1
Gym L	38	48	6.9	6292.8
Walkway	8.2	48	3.3	649.4
Café	51.5	31	2.3	1836.0
Passage to Tower	Assumed Flat			
Stairwell over Café	9.8	6	0.7	20.6

	Max Volu	me	201819.2
ACALL ON	D11-70	(1-: (6)	Volume
		Height (ft)	
	21.5		330.6
	24.5		298.6
	24.5		744.2
	24.5	3.8	3002.5
	16.5		1862.4
40.5	24.5	4.5	2232.6
	24.5		298.6
42.5	40.5	5.8	4991.6
	40.5		1577.5
25.5	11.5		307.9
	48.5	7.4	5796.2
	48.5		6908.8
8.7	48.5	3.8	801.7
52	31.5	2.8	2293.2
10.3	6.5	1.2	40.2
	Max Roof	Volume	31486.6

Width (ft)	Donth (4)	Unight (6)	Volume (cubic feet)
19.5	Deptn (π) 20.5	Height (ft)	
15.25	23.5	25.6 24.4	10233.6
39.5	23.5	15.5	8744.4 14387.9
63.5	23.5	7.5	11191.9
63.5	15.5	7.5	7381.9
39.5	23.5	15.5	14387.9
15.25	23.5	24.4	8744.4
41.5	39.5	10.3	16884.3
19.5	39.5	18.5	14249.6
24.5	10.5	6.4	1646.4
85.8	47.5	11.6	47275.8
7.7	47.5	1.6	585.2
77	30.5	7.7	18083.5
10.5	9.3	7.5	732.4
9.3	5.5	3.7	189.3
0.0	0.0	5.7	100.0
	Min Volume		174718
			1/1
\ A (! -	D	11-1-1-1-1-10	Volume
Width (ft) 19.5	Deptn (π) 20.5	Height (ft) 0.5	
15.25	23.5	0.5	99.9
39.5	23.5	0.5	89.6
63.5	23.5	2.8	232.1 2089.2
63.5	15.5	2.5	1230.3
39.5	23.5	3.5	1624.4
15.25	23.5	0.5	89.6
41.5	39.5	4.8	3934.2
19.5	39.5	2.8	1078.4
24.5	10.5	1.1	141.5
31.3	47.5	6.4	4757.6
37.5	47.5	6.4	5700.0
7.7	47.5	2.8	512.1
51	30.5	1.8	1400.0
51	30.5	1.0	1400.0
9.3	5.5	0.2	5.1
	Min Roof Vo		22983

13550.505 Cubic Metres

4251.36 Cubic Metres

Total Volume:	215103	+/-	17802	Cubic Feet	
	7967	+/-	659	Cubic Yards	

Roof Volume

Total Volume Max Volume

Min Volume

27115.3 215102.6

233305.8

197702.0

Notes

^{1.} This is the original volume of the un-damaged building.

^{2.} This calculation does not allow for lost space due to the fabric of the building

^{3.} Some assumptions have been made about internal layout

^{4.} In order to calculate internal volume, some knowledge of the inner fabric would be required.

BUILDING VOLUMES

Error Calculation

	Calculated Vo	olume		
Mainanaa	JAC-HI- (C)	D 11- 150	11.1.1.1.20	Volume
Mainspace	Width (ft)	Depth (ft)	Height (ft)	(cubic feet)
Main Tower	20	21	26.1	10962.0
Tower L	15.75	24	24.9	9412.2
Block L	40	24	16	15360.0
Accomodation Lower Floor	64	24	8	12288.0
Accomodation Upper Floor	64	16	8	8192.0
Block R	40	24	16	15360.0
Tower R	15.75	24	24.9	9412.2
Chapel	42	40	10.8	18144.0
Bedroom/Gunroom	20	40	19	15200.0
Lean-to	25	11	6.9	1897.5
Gym	86.3	48	12.1	50123.0
Walkway	8.2	48	2.1	826.6
Café and Tower Base	77.5	31	8.2	19700.5
Passage to Tower	11	9.8	8	862.4
Stairwell over Café	9.8	6	4.2	247.0
		Volume		187987.4
				Volume
Roofspace	Width (ft)	Depth (ft)	Height (ft)	(cubic feet)
Main Tower	20	21	1	210.0
Tower L	15.75	24	1	189.0
Block L	40	24	1	480.0
Accomodation Lower Floor	64	24	3.3	2534.4
Accomodation Upper Floor	64	16	3	1536.0
Block R	40	24	4	1920.0
Tower R	15.75	24	1	189.0
Chapel	42	40	5.3	4452.0
Stage/Bedroom	20	40	3.3	1320.0
_ean-to	25	11	1.6	220.0
Gym R	31.8	48	6.9	5266.1
Gym L	38	48	6.9	6292.8
Walkway	8.2	48	3.3	649.4
Café	51.5	31	2.3	1836.0
Passage to Tower	Assumed Flat		2.5	1030,0
Stairwell over Café	9.8	6	0.7	20.6
		Roof Volume		27115.3

	Max Roof	Volume	31486.6
10.3	6.5	1.2	40.2
52	31.5	2.8	2293.2
8.7	48.5	3.8	801.7
38.5	48.5	7.4	6908.8
32.3	48.5	7.4	5796.2
25.5	11.5	2.1	307.9
20.5	40.5	3.8	1577.5
42.5	40.5	5.8	4991.6
16.25	24.5	1.5	298.6
40.5	24.5	4.5	2232.6
64.5	16.5	3.5	1862.4
64.5	24.5	3.8	3002.5
40.5	24.5	1.5	744.2
16.25	24.5	1.5	298.6
20.5	21.5	1.5	330.6
Width (ft)	Depth (ft)	Height (ft)	(cubic feet)
			Volume
	Max Volur	ne	201819.2
10.0			
10.3	6.5		
11.5	10.3	8.5	1006.8
78	31.5	8.7	21375.9
8.7	48.5		1097.1
25.5 86.8	48.5	12.6	2170.1 53043.5
20.5 25.5	40.5 11.5	19.5 7.4	16189.9
42.5	40.5		19450.1
16.25	24.5	25.4	10112.4
40.5	24.5	16.5	16372.1
64.5	16.5		9046.1
64.5	24.5	8.5	13432.1
40.5	24.5	16.5	16372.1
16.25	24.5	25.4	10112.4
20.5	21.5	26.6	Volume (cubic feet) 11724.0

linimum Vo	idillo		Volume
Width (ft)	Depth (ft)	Height (ft)	(cubic feet)
19.5	20.5	25.6	10233.6
15.25	23.5	24.4	8744.4
39.5	23.5	15.5	14387.9
63.5	23.5	7.5	11191.9
63.5	15.5	7.5	7381.9
39.5	23.5	15.5	14387.9
15.25	23.5	24.4	8744.4
41.5	39.5	10.3	16884.3
19.5	39.5	18.5	14249.6
24.5	10.5	6.4	1646.4
85.8	47.5	11.6	47275.8
7.7	47.5	1.6	585.2
77	30.5	7.7	18083.5
10.5	9.3	7.5	732.4
9.3	5.5	3.7	189.3
	174718.2		
			Volume
Width (ft)		Height (ft)	(cubic feet)
19.5	20.5	0.5	99.9
15.25	23.5	0.5	89.6
39.5	23.5	0.5	232.1
63.5	23.5	2.8	2089.2
63.5	15.5	2.5	1230.3
39.5	23.5	3.5	1624.4
15.25	23.5	0.5	89.6
41.5	39.5	4.8	3934.2
19.5	39.5	2.8	1078.4
24.5	10.5	1.1	141.5
31.3	47.5	6.4	4757.6
37.5	47.5	6.4	5700.0
7.7	47.5	2.8	512.1
51	30.5	1.8	1400.0
9.3	5.5	0.2	5.1
Min Roof Volume			22983.8

13550.505 Cubic Metres

4251.36 Cubic Metres

Minimum Volume

	·	mir volume	107702.0
F-4-11/-1	045400		47000 0 1: 5
Total Volume:	215103	+/-	17802 Cubic Feet

Total Volume

Max Volume

7967 +/- 659 Cubic Yards

This is the original volume of the un-damaged building.

215102.6

233305.8

Notes

Building Volume

Roof Volume

187987.4

27115.3

^{2.} This calculation does not allow for lost space due to the fabric of the building

^{3.} Some assumptions have been made about internal layout

^{4.} In order to calculate internal volume, some knowledge of the inner fabric would be required.

IMAGERY INTERPRETABILITY RATING SCALES (IIRS)

An imagery interpretability scale is a tool used by people to make and communicate quantitative judgments about the potential interpretability of an image. The aerial imaging community utilizes the Imagery Interpretability Rating Scale (IIRS) to define and measure the quality of images and performance of imaging systems. Through a process referred to as "rating" an image, the IIRS is used by imagery analysts to assign a number, which indicates the interpretability of a given image.

The IIRS concept provides a means to directly relate the quality of an image to the interpretation tasks for which it may be used. Although the IIRS has been primarily applied in the evaluation of aerial imagery, it provides a systematic approach to measuring the quality of photographic or digital imagery, the performance of image capture devices, and the effects of image processing algorithms.

Background and Objective

The need to measure the quality or usefulness of an image is fundamental to the design and operation of imaging systems. A scale was designed to overcome the drawbacks of resolution. The IIRS is used by imagery analysts to assign a numerical rating to quantify the interpretability of an image. Interpretability is defined as a measure of how useful an image is for analysis or exploitation purposes. The IIRS provides a common scale, which can be used with different imaging systems. Studies and experience have shown that IIRS ratings by trained imagery analysts are accurate and precise. These ratings are made using typical scene content where no special test targets are required.

The IIRS provides a unique tool to objectively measure the subjective quantity of image interpretability. It is used for a variety of purposes within the aerial imaging community; however, its application outside that community has been limited.

IIRS Definition

The IIRS is composed of 10 rating levels, from 0 to 9, the higher the IIRS rating, the higher the imagery interpretability. To define the interpretability at a specific IIRS level, textual descriptors, referred to as IIRS criteria, are used. IIRS criteria are descriptions of common interpretation tasks that can be performed by an imagery analyst. In total, 55 criteria comprise the 10 IIRS levels; six criteria each at levels 1 through 9 and a single criterion at IIRS 0. The use of multiple criteria at each IIRS level is in part due to specialties by which imagery analysts have traditionally been organized, for example by air, electronics, ground, missile and naval categories. By having several criteria, an individual familiar with a particular criterion has other references to help understand the intended interpretability of that IIRS level. Because the IIRS criteria fall into categories related to military equipment, an airfield image, for example, is not likely to have examples of naval criteria present. To improve the possibility of specific IIRS criteria being present in an image, a cultural or non-military IIRS category provides examples of civilian equipment which may be seen in imagery more frequently than specific military content.

Rating an Image with the IIRS

The IIRS criteria are used as a reference to quantify, or rate, the interpretability of an image. To rate an image as a IIRS 5, for example, an imagery analyst must be able to accomplish all the IIRS 4 criteria and at least one IIRS 5 criterion. Conceptually, the

analyst must judge that the physical attributes or quality of the image are such that each of the IIRS 4 and one IIRS 5 criteria could be exploited. It is not a requirement to have the IIRS criteria present in an image to be rated. Experienced imagery analysts can successfully make IIRS judgments even if the specific criteria content is not present.

A certification process is used to qualify analysts to give IIRS ratings. Imagery that has been rated by a large number of analysts is used for both training and certification. Analysts are instructed in the IIRS procedure and given imagery examples at each IIRS level for familiarisation. A certification test must be passed in which an imagery analyst correctly rates a set of imagery within an acceptable error bound. In practice, imagery analysts often rate imagery without direct reference to the criteria listings. With experience, analysts establish an internal sense of the IIRS and can provide ratings consistent with their peers.

Image-Based IIRS

IIRS is defined by the 55 criteria, which comprise the scale. However, imagery examples which have been previously rated can also provide a means to rate imagery. Calibrated images spaced at uniform IIRS increment function as a visual reference to which test imagery may be compared. An observer judges the relative position where a test image falls between two calibrated images. A rating for the test image is derived by interpolation using the IIRS values for the calibrated images. Having all images in view facilitates the relative placement of each individual image. Observers are able to make multiple comparisons among images to judge correct placement. Imagery can be scaled on a softcopy display.

IIRS has been used to account for all factors that affect image interpretability. Image scale, measured as photographic scale (film system) or Ground Sampled Distance (GSD in an electro-optical system), has a significant impact on the measured interpretability. Scale or GSD alone does not determine the IIRS of an image as sharpness, noise, and contrast also impact the NIIRS. These effects may be due to system characteristics (e.g. optical quality, focal plane performance), acquisition parameters (e.g., sun angle, atmospheric transmission, atmospheric haze), and exploitation conditions (e.g., film duplication, softcopy monitor quality). It is also possible to relate collection and exploitation system characteristics to the IIRS.

By design, the IIRS is independent of any particular imaging system and provides an unbiased measure of image interpretability. Although principally applied to complex aerial imaging systems, the IIRS concept, development methodology, and measurement tools provide developers and users of other imaging systems a statistical process to define and measure performance as it relates to the ultimate use of a system.

Infrared National Imagery Interpretability Rating Scale (NIIRS) -April 1996

RATING LEVEL 0

Interpretability of the imagery is precluded by obscuration, degradation, or very poor resolution.

RATING LEVEL 1

Distinguish between runways and taxiways on the basis of size, configuration or pattern at a large airfield. Detect a large (eg., greater than 1 square kilometer) cleared area in dense forest. Detect large ocean-going vessels (e.g., aircraft carrier, supertanker, KIROV) in open water. Detect large areas (e.g., greater than 1 square kilometer) of arsh/swamp.

RATING LEVEL 2

Detect large aircraft (e.g., C-141, 707, BEAR, CANDID, CLASSIC).

Detect individual large buildings (e.g., hospitals, factories) in an urban area.

Distinguish between densely wooded, sparsely wooded and open fields.

Identify an SS-25 base by the pattern of buildings and roads.

Distinguish between naval and commercial port facilities based on type and configuration of large functional areas.

RATING LEVEL 3

Distinguish between large (e.g., C-141, 707, BEAR, A-300 AIRBUS) and small aircraft (e.g., A-4, FISHBED and L-39). Identify individual thermally active flues between the boiler hall and smoke stacks at a thermal power plant. Detect a large air warning radar site based on the presence of mounds, revetments and security fencing. Detect a driver-training track at a ground forces garrison. Identify individual functional areas (e.g., launch sites, electronics areas, support areas, missile handling area) of a SA-5 launch omplex. Distinguish between large (e.g., greater than 200 meter) freighters and tankers.

RATING LEVEL 4

Identify the wing configuration of small fighter aircraft (e.g., FROGFOOT, F-16, FISHBED). Detect a small (e.g., 50 meter square) electrical transformer yard in an urban area. Detect large (e.g., greater than 10-meter diameter) environmental domes at an electronics facility. Detect individual thermally active vehicles in garrison. Detect thermally active SS-25 MSVs in garrison. Identify individual closed cargo hold hatches on large merchant ships.

RATING LEVEL 5

Distinguish between single-tail (e.g., FLOGGER, F-16, TORNADO) and twin-tailed (e.g., F-15, FLANKER, FOXBAT) fighters.

Identify outdoor tennis courts.

Detect armoured vehicles in revetments

Detect a deployed TET (transportable electronics tower) at An SAM site.

Identify the stack shape (e.g., square, round, oval) on large (e.g., greater than 200 meter) merchant ships.

RATING LEVEL 6

Detect wing-mounted stores (i.e., ASM. bombs) protruding from the wings of large bombers (e.g., B-52, BEAR, BADGER). Identify individual THERMALLY active engine vents atop diesel locomotives.

Distinguish between a FIX FOUR and FIX SIX site based

Distinguish between a FIX FOUR and FIX SIX site based on antenna pattern and spacing,. Distinguish between THERMALLY active tanks and APCS. Distinguish between a 2-rail and 4-rail SA-3 launcher. Identify missile tube Icicles on submarines.

RATING LEVEL 7

Distinguish between round attack and interceptor versions the MIG-23 FLOGGER based on the shape of the nose. Identify automobiles as sedans or- station wagons. Identify antenna dishes (less than 3 meters in diameter.) or/a radio relay tower

Identify the missile transfer crane on a SA-6 transloader. Distinguish between an SA-2/CSA-1 and a SCUD-B missile transporter when missile are not loaded Detect mooring cleats or bollards on piers.

RATING LEVEL 8

Identify the RAM airscoop on the dorsal spine of FISHBED J/K/L.

Identify limbs (e.g., arms, legs) on an individual. Identify individual horizontal and vertical ribs on a radar antenna

Detect closed hatches on a [auk turret.

Distinguish between fuel and oxidizer Multi-System propellant Transporters based on twin or single fitments on the front of the semi-trailer.

Identify individual posts and rails on deck edge life rails.

RATING LEVEL 9

Identify access panels on fighter aircraft. Identify cargo (e.g., shovels, rakes, and ladders) in an open-bed, light-duty truck. Distinguish between BIRDS EYE and BELL LACE antennas based on the presence or absence of small dipole elements. Identify turret hatch hinges on armoured vehicles. Identify individual command guidance strip antennas on an SA-2/CSA-1 missile. Identify individual rungs on bulkhead mounted ladders.

Forensic Pathology Evaluation of the 1993 Branch Davidian Deaths and Other Pertinent Issues

Prepared for the

Office of Special Counsel John C. Danforth

By

Michael A. Graham, M.D.

Professor of Pathology Co-director, Division of Forensic Pathology Saint Louis University School of Medicine

> Chief Medical Examiner City of Saint Louis, Missouri

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	1. Michael Graham, M.D.	Attached

I. Introduction

At the request of the Office of Special Counsel (OSC), I reviewed a variety of materials pertinent to the Mount Carmel, Texas confrontation. I was asked to evaluate the authority under which the examinations of the decedents were carried out; evaluate adequacy and accuracy of the recovery and examination processes; identify significant obstacles to the recovery and examination processes; evaluate the reliability of the data; comment on opinions and statements made by other experts and non-experts; interpret the available information in order to offer independent opinions as to the nature, extent and effects of injuries/diseases, their potential significance and how they may have been sustained; offer opinions as to the causes and manners of the deaths; address other pertinent issues as they arise during the investigation; and, serve as a source of information/advice to the staff of the Office of Special Counsel. My review does not include evaluating the deaths of the four government agents killed by gunfire during the initial confrontation on February 28, 1993. All of my opinions are stated to a reasonable degree of medical certainty unless otherwise specified.

My opinions are based on my review of the following information:

- 1. Tarrant County Medical Examiner's Office records including the autopsy records, toxicology reports, dental charting, summary sheets and forensic laboratory reports
- 2. Tarrant County Medical Examiner's Summary Report (September 29, 1993)
- 3. Radiographs of the decedents
- 4. Photographs of the bodies at the scene and during the examinations in the morgue
- 5. Anthropology reports prepared by Drs. Owsley and Ubelaker
- 6. Transcribed preliminary anthropology notes
- 7. DNA test results (Armed Forces DNA Identification Laboratory)
- 8. Death certificates
- 9. Schematic drawings of the complex (pre- and post-fire)
- 10. Fire investigation expert report
- 11. Dr. Jerry Spencer's report and deposition testimony
- 12. United Kingdom (UK) forensic experts' reports and accompanying documents pertaining to second autopsies performed on repatriated Davidian remains
- 13. Greater Manchester (UK) Police witness' statements
- 14. Dr. Joseph Burton's forensic pathology consultation report regarding his review of information about several of the Davidian deaths
- 15. Dr. Patrick Fardal's (forensic pathologist) affidavit summarizing his opinions based on his review of information about several of the Davidian deaths
- 16. Dr. Paul Radelat's (consulting pathologist) report regarding his review of information about several of the Davidian deaths
- 17. Dr. Ronald Graeser's report and letter containing his opinions based on his examination of the remains of James Riddle

- 18. List of FBI Hostage Rescue Team (HRT) munitions present on April 19, 1993
- 19. Portions of FBI laboratory reports
- 20. Manuscripts of article for publication and published article (Owsley DW, J Forensic Sci, JFSCA, Vol 40, May 1995, pp 341-348) regarding the forensic anthropology aspects of the event at Waco
- 21. Excerpts from David Thibodeau's book <u>A Place Called Waco–A Survivor's Story</u> (excerpts dealing with a listing of the dead and specific details about the deaths of Perry Jones, Winston Blake, Peter Gent, Peter Hipsman and Jaydean Wendell)
- 22. Excerpt from Kathryn Schroeder's testimony discussing the deaths of Perry Jones and Peter Hipsman
- 23. Records from the State of Maryland Medical Examiner's Office (including police reports) pertinent to the death of Carlos Ghigliotty
- 24. Select medical records relating to the treatment of Clive Doyle
- 25. Select portions of U.S. Treasury Department, FBI and Texas Department of Public Safety (DPS) investigation reports pertaining to Judy Schneider's hand gunshot injury

The Branch Davidian complex, known as Mt. Carmel, was located in McLennan County, Texas, near the city of Waco. Jurisdiction over the death investigation, as per Texas state law, was assumed by the McLennan County Justices of the Peace. The Tarrant County Medical Examiner's Office (TCMEO) assisted the Justices of the Peace as independent examiners. The examinations of the remains were carried out at the Tarrant County Medical Examiner's Office. The death certificates were completed by McLennan County officials.

TCMEO personnel examined the bodies of four law enforcement agents who were killed by gunfire during the initial confrontation on February 28, 1993. They also examined the body of Davidian Michael Schroeder (currently referred to as MC 81) who was also killed by gunfire on February 28, 1993, and whose body was recovered on March 4, 1993, from a low lying area in a catch pen property (hereafter referred to for convenience as a "ravine").

On April, 20, 1993, the first remains of the Branch Davidian decedents was received at the TCMEO. TCMEO personnel went to the fire scene on April 21, 1993, to help in planning and carrying out the recovery of other decedents. TCMEO personnel were later supplemented at the scene by anthropology personnel from the Smithsonian Institute and the FBI. Surface and excavation recoveries including documentation, evidence recovery/preservation, body recovery, transport and storage were carried out using standard accepted techniques. Remains were recovered from the areas of the stage at the rear of chapel, stage stairways, communications room, kitchen/serving area, kitchen-stairways, front of concrete bunker, hallways, top of concrete bunker and concrete bunker (surface and excavated). In addition, bodies that had been buried within the complex after the initial confrontation on February 28, 1993, were exhumed from grave sites near the front of the complex (1) and from a concrete tornado shelter (4).

2. The remains were processed and examined by a multi-agency multi-disciplinary team of experts and support personnel under the overall supervision of Nizam Peerwani, M.D. (forensic pathologist and Tarrant County Chief Medical Examiner). The processing/examining personnel consisted of forensic pathologists, dentists, anthropologists, latent print examiners, toxicologists, criminalists, photographers, radiology technician and support personnel. Additional anthropology assistance was rendered by personnel from the University of Tennessee (Knoxville).

Prior to examination, each single body was fluoroscoped, radiographed and photographed. Evidentiary material accompanying the bodies, including a large amount of munitions, was removed and packaged. Co-mingled remains were separated by the anthropology personnel. Clothing on the bodies was inventoried and preserved. The bodies underwent full autopsy examination by a forensic pathologist. Examinations, when applicable, were also carried out by the anthropologists. The dental examinations were carried out by the dentists.

The identifications of the bodies were established scientifically using dental, fingerprint, radiographic and DNA techniques. The identities of some bodies were confirmed using a combination of methods.

The repatriated remains of 10 Davidian decedents (MC 2, 21, 22, 23, 27, 37, 61, 74, 75, 77) underwent second postmortem examinations in the UK by Home Office forensic pathologists assisted by other personnel including individuals with expertise in odontology and firearms. It appears that the UK pathologists did not have access to all the information in the original examination autopsy reports, with the exception of Rosemary Morrison (MC 75). Some documentation, including the TCMEO-determined causes of the deaths, was available.

The examinations by the UK pathologists were complicated by the presence of decomposition, fire effects and alterations incurred during the previous examinations. The UK pathologists did not recover any bullets that had been discharged through a firearm barrel.

A UK firearms expert does indicate he reviewed a variety of investigative reports. He speculated about the nature of some of the wounds and ammunition, apparently without knowledge of pertinent findings made during the TCMEO autopsies (MC 37, 21, 77), which are critical to the proper interpretation of the injuries, contradict his statements and demonstrate them to be incorrect. In addition, the firearms expert's statements about MC 37 appear erroneous and contradictory to both the TCMEO and the UK autopsy pathologists' observations.

In general, the UK examinations did not add any significant new observations regarding the injuries or causes of the deaths. Specific comments about the UK examinations and conclusions are included in the individual case summaries. The causes of a few inconsistencies between the TCMEO and UK observations are not readily apparent (see MC 22 case synopsis).

II. Review Summary

The overall process for recovering, identifying and examining the Branch Davidian bodies was carried out with proper authority and planning in an appropriate fashion by properly qualified personnel. The examinations were significantly hindered by the effects of fire, decomposition and, to a lesser extent, structural collapse. In some cases these hindrances detrimentally affected the pathologists' abilities to offer opinions about the cause of death and other pertinent issues. Overall, the descriptions of the observations made during the postmortem examinations appear to be accurate and reliable.

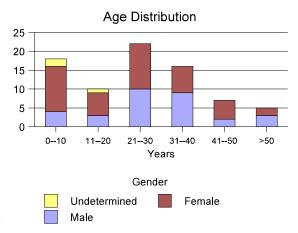
The recovered remains indicate the presence of at least 82 persons (not including 2 fetuses). DNA analyses indicate that some of the separately recovered remains originate from the same individual. In addition to these fragmented remains that are associated via DNA analyses, circumstantial evidence suggests that other separately numbered remains of some children may also originate from a common source. For instance, it is likely that MC-70 and MC-51A are the same child. It is possible, although not quite as convincing, that MC 67-7 and MC 67-8 are from a single child (distinct from the MC-70/51A child). The presented numerical data is based on a total of 28 children (18 years of age or less). If the 2 presumptive associations noted above are inaccurate and the remains, in fact, originate from 3 or 4 separate persons, the numerical data would be altered accordingly.

There is also circumstantial evidence strongly supporting the presence of another adult Branch Davidian decedent (Paulina Henry, 24 years old, Black, female) whose remains were not recovered. Her presumed death (cause undetermined) is not included in the numerical data expressed in this report.

The identities of the Branch Davidian decedents were established using standard forensic techniques including fingerprint, radiographic, dental and DNA comparisons. More than one

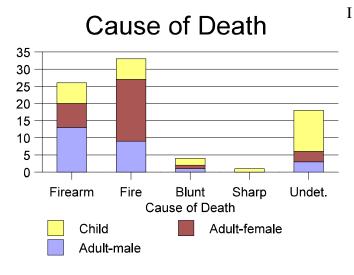
technique was used in identifying some of the individual decedents. Five individuals, all children, remain unidentified.

The recovered remains include 54 adults (26 men and 28 women), 28 children (4 males, 21 females and 3 of undetermined gender) and 2 fetuses. The ages of the decedents range from 1-76 years (mean/median age–25/27 years). The mean age of the adults is 34 years (median age 31 years). Adult males and females are of similar ages (mean/median age–35/32 years and 33/30 years respectively).

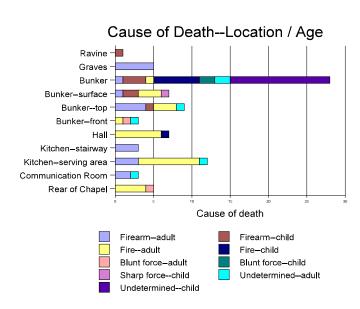


The children range in age from 1-18 years with a mean age of 8 years (median age 6 years). The mean/median ages of the males and females are 6/7 years and 8/6 years respectively.

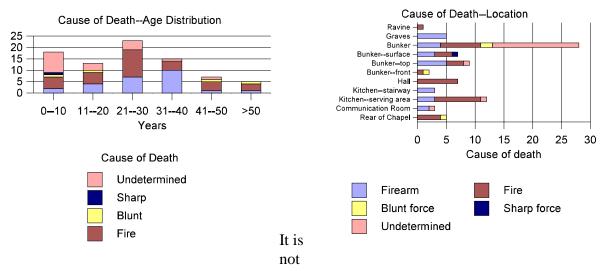
Forty eight of the adults and all the children were recovered from the burned structure. Most of the children were found in proximity to their mothers. An additional 4 adults were recovered from a subterranean grave site, 1 adult from a different shallow grave and 1 from a ravine.



I determined the cause of death in 64 of the decedents and in 18 others I concluded the cause of death was indeterminate. Branch Davidian decedents recovered from the burned structure died of firearm injuries (20), smoke inhalation/thermal burns (33), blunt trauma (4), sharp trauma (1) and undetermined causes (18). The 6 bodies, all adults, recovered from the graves and ravine all died of gunshots.



Among the adults, 20 died of firearm injuries, 26 of smoke inhalation/thermal burns, 2 of blunt trauma and 6 of undetermined causes. The children died due to gunshot wounds (6), fire (7) blunt trauma (2), sharp trauma (1) and undetermined causes (12). Some of the cases having an identified cause of death also demonstrate other injuries that may have played a contributory role in the death. These contributory injuries are described in the individual case synopses. In other cases, the conditions of the remains prevent determining or excluding the presence of potentially lethal or disabling injuries.

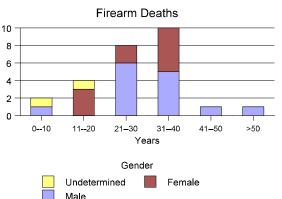


possible to determine the cause of death of a particular child based upon the cause of death of the mother. It is also difficult to discern any general trends between the cause of death of the mother and those of her children. Much of this difficulty is due to the large number of undetermined causes of death. Of the liveborn children parented by David Koresh, fire killed 4, 1 was stabbed and the causes of the deaths of 5 others could not be determined. Each of these children, along with the two women pregnant by David Koresh, were found in the concrete bunker.

II-2. Firearm Injuries

Deaths were ascribed to firearm injuries when the wounding resulted in demonstrable or reasonably predictable injuries typically associated with lethality in the absence of medical care (the observed gunshot wounds of the head would have predictably been lethal even if medical care had been readily available). The deaths of some individuals with gunshot wounds may have been hastened by the structural fire.

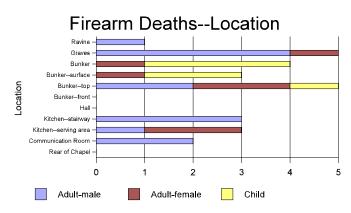
A total of 26 deaths are attributed to firearm injuries--20 from the burned structure, 4



from the concrete tornado shelter graves (MC 77, MC 78, MC 79, MC 80), 1 from a shallow grave (MC 76) and 1 from a ravine (MC 81). Of the 20 individuals recovered from the burned structure, 14 were adults (MC 7, 8, 43, 44, 45, 20, 21, 22, 34, 36, 39, 41, 47 and 66) and 6 were children (MC 35, 31A, 31 DE, 53, 56, 67-7/67-8). The ages of the children were circa 13 months, 5 ½-6 ½ yr, 11 yr, 11-14 yr, 17 yr and 18 yr. Only adults were recovered from the graves and ravine.

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Davidians killed by firearms and later recovered from the burning structure were found in the communications room (MC 7, 8), kitchen/stairway/serving area (MC 43, 44, 45), (MC 20, 21, 22), top of concrete bunker (MC 34, 35, 36, 39, 41), on the surface in the concrete bunker (MC 31A, 31DE, 47) and in the concrete bunker debris (MC 53, 56, 66, 67-7/67-8). Each of the Branch Davidian decedents succumbed to handgun/rifle injuries except one, MC 47, who died of a shotgun wound to the head. There were 16 Branch Davidian decedents with gunshot/shotgun wounds restricted to the head (12 adults and 4 children) (14 with single shots and 2 with multiple shots), 6 with gunshot injuries isolated to the torso (4 adults and 2 children) and 4 having gunshots to the head and torso (4 adults).



The determination of muzzle-

victim distance, i.e. range of fire, involves identifying the presence and/or absence on or in the body of a variety of materials that are discharged from the muzzle of the gun in addition to the projectile. These materials include flame, gas, smoke and gunpowder particles. The presence of searing, tissue disruption by gas and/or soot-powder propelled into the wound track indicates the muzzle of the gun was in contact with or very close to the surface when the gun was discharged.

Gunsmoke deposited on the surface of the body, usually in conjunction with marks caused by powder particles striking the body (powder stippling or tattooing) denote a close range wound (usually within approximately 1 foot). Powder stippling in the absence of smoke indicates a maximum range of fire of 2-3 feet depending on a variety of factors including the physical configuration of the gunpowder particles. Any material between the muzzle and the skin surface (such as clothing, dense scalp hair or other intermediate target) may affect the ability of these firearm discharge products from reaching the skin and thus affect the ability to accurately determine the range of fire. In the absence of material interposed between the muzzle and the target, wounds lacking the aforementioned features are classified as distant wounds. It should be remembered that in scientific parlance a distant wound is generally any wound received in excess of a few feet and does not necessarily entail great distances between the shooter and target. The progressive spread of shotgun pellets as the muzzle-target distance increases is also used to further estimate the range of fire in shotgun wounds caused by pellets.

All of the gunshot injuries seen in the decedents recovered from the burned structure are

consistent with having been received from guns fired from within the structure itself. I do not see any evidence to indicate any of the Branch Davidian decedents recovered from the burned structure received gunshot injuries originating outside the complex on April 19, 1993. There is no pathological evidence to suggest than any firearm death on April 19, 1993, was caused by a U.S. Government agent. Determination of the range of fire is able to be made in 12 Davidian gunshot fatalities and, to a limited degree, in the shotgun wound death. The effects of fire and decomposition preclude determining the range of fire in 13 decedents. Range of fire determinations are made in individuals recovered from the burned structure (MC 7, 8, 20, 21, 41, 31DE, 47), burial sites (MC 76, 77, 78, 79, 80) and ravine (MC 81). Of the 20 individuals recovered from the burned structure, range of fire is able to be determined in wounds involving 6 of them (5 adults and 1 child). Each of these individuals (MC 7, 8, 20, 21, 41, 31DE) have head wounds involving very close-contact range. Ranges of fire of other gunshot wounds are not able to be determined due to the loss of tissue at the entry sites and, in some cases, the loss of interposed clothing. The absence of the aforementioned markers used to determine the range of fire in those cases where alterations of the body (i.e., decomposition, fire, loss of interposed clothing) may have obscured or erased them does not mean the wounds are distant range wounds. The adult with the shotgun wound (MC 47) sustained the injury at a muzzle-target distance before the pellets extensively spread (certainly from a shotgun discharged within the complex).

The extent of the tissue damage and the ammunition recovered from the bodies indicates wounding by low velocity ammunition with the exception of 1 person recovered from a grave (MC 77) who sustained a very close/contact range high velocity gunshot injury to the head (.223 caliber). Although one of the experts who previously reviewed some of the deaths opined that the .223 injury was received from a substantial distance or through an intermediate target because the bullet did not perforate the head as, according to this expert, a high velocity bullet would, the deposition of grossly apparent gunpowder in the depths of the wound conclusively indicates that the gunshot was received at very close/contact range. I did not see any wounds that suggested to me the use of a sniper rifle (.50 caliber or .308 caliber).

Branch Davidian decedents with wounds consistent with being self-inflicted were found in the burned structure (MC 7, 8, 43, 20, 21, 41) and graves (MC 77, 80). Some areas of the burned structure contained remains of more than one person having wounds consistent with being self-inflicted. However, even though these wounds could have been self-inflicted, the possibility that they were inflicted by another person cannot be excluded. Determining whether a gunshot wound is self-inflicted or not involves assessing the range of fire, accessability of the entry site and physical/mental capability of the person. Any wound that is consistent with being self-inflicted could also have been inflicted by another person. Self-inflicted wounds are usually in relatively predictable sites but are not exclusive or restricted to these sites.

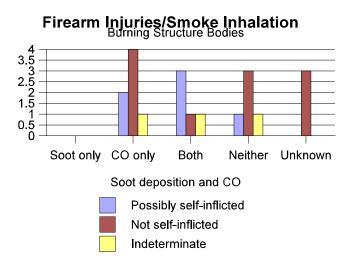
A large number of the gunshot wounds of the head found in the remains involved entry sites typical of self-infliction (forehead, temple, oral cavity). The range of fire of some of these wounds was able to be determined and found to be very close-contact. All the contact gunshot wounds of the head found in adult Branch Davidian decedents recovered from the burned structure involved entry sites typical of being self-inflicted. However, when interpreting these

"typical" injuries it must be remembered that they were not sustained in a "typical" event; instead, they have been sustained in an "atypical" situation by individuals who are not "typical" members of the general population.

Overall, the pattern of the gunshots involving the head supports self-destruction either by overt suicide, consensual execution (suicide by proxy) or, less likely, forced execution by "death squad." At least one child (MC 31DE) sustained a very close-contact gunshot wound. The wounds sustained by 5 adults (MC 45, 22, 36, 39, 66) and 6 children (MC 35, 31A, 31DE, 53, 56, 67-7/67-8) recovered from the burned structure do not appear to be self-inflicted. Not enough information is available to assess whether the wounds of 3 other Branch Davidian decedents (MC 34, 44, 47) were likely self-inflicted. Two bodies recovered from the concrete tornado shelter grave site have gunshot wounds involving the head which may have been selfinflicted. The entry site involving the .223 injury (MC 77) is accessible to self-infliction using this type of weapon but is not a typical entry site of a self-inflicted rifle injury and is more likely a wound inflicted by someone else. The other body (MC 80) has an intraoral gunshot entry site which, although it is a very typical entry site for a self-inflicted injury, it is not necessarily selfinflicted and can be inflicted by someone else. In this case (MC 80), surviving Branch Davidians Kathryn Schroeder and David Thibodeau indicate Mr. Jones may have been killed by another Branch Davidian. The wounds of the other individuals recovered from the graves and from the ravine are not consistent with being self-inflicted.

Some of the distant entry wounds found in the Branch Davidian decedents buried in graves or found in the ravine were caused by government agents during shooting incidents on February 28, 1993. One Branch Davidian decedent (MC 79) sustained gunshot wounds of the torso and arm apparently from government agents' fire and was subsequently executed by a fellow Branch Davidian who administered two lethal close-contact wounds to the head/neck area. One Branch Davidian (MC 8) apparently received a non-lethal gunshot during the firefight associated with the initial confrontation at the complex and subsequently received a lethal gunshot to the head on the day of the fire. Another Branch Davidian (MC 51) who died of undetermined cause on the day of the fire had received a gunshot wound of the hand on February 28, 1993.

The characteristics of the wounds also allow some assessment of the accuracy of accounts offered by various individuals involved in the incident describing the course of events (see case evaluations regarding MC 76, 77, 79, 80 and 81).



The demonstration of smoke inhalation as evidenced by the presence of soot in the airway and elevation of the blood/tissue CO saturation indicates that at least 4 adults (MC 8, 41, 43, 44) and 1 child (MC 53) who died of firearm injuries were alive when they were exposed to smoke from the fire. Four other Davidian adults (MC 20, 22, 36, 47) and 1 child (MC 56) who died of firearm injuries showed no evidence of breathing smoke as indicated by the lack of soot in the airways and no elevation of blood/tissue CO saturation. The presence or absence of smoke inhalation cannot be definitively assessed in another 5 adults (MC 7, 45, 21, 34, 39) and 2 children (MC 35, 31A) in whom elevated CO saturation

was reported in the absence of airway soot (see toxicology section discussion regarding interpretation of CO laboratory results) and in an additional adult (MC 66) and 2 children (MC 31DE, 67-7/67-8) in whom the postmortem effects of fire and decomposition prevent smoke inhalation assessment. As noted above, the deaths of some of the individuals who sustained firearm injuries may have been hastened by the fire.

Among individuals with firearm injuries who were recovered from the burned structure, soot and CO were identified in 4 adults (MC 8, 41, 43, 44) and 1 child (MC 53), CO alone was reported in 5 adults (MC 7, 45, 21, 34, 39) and 2 children (MC 35, 31A) [see toxicology discussion regarding CO interpretation], neither soot nor CO in 4 adults (MC 20, 22, 36, 47) and 1 child (MC 56) and soot/CO were not evaluated in 1 adult (MC 66) and 2 children (MC 31DE, 67-7/67-8). Thus, there is evidence that at least 5 Davidians who died of firearm injuries were alive when exposed to smoke and 5 others showed no evidence of being exposed to smoke while alive. As noted above, the deaths of some of the individuals who sustained firearm injuries may have been hastened by the fire.

Circumstantial evidence strongly suggests that at least 2 other Davidians died of firearm injuries--MC 6 and MC 64 and/or MC 65. MC-6 has no evidence of smoke inhalation to indicate he was alive when exposed to smoke from the fire. He has no identifiable lethal injury but postmortem burning has destroyed most of the head preventing adequate examination to establish or exclude the presence of a head wound. MC-6 was found in the same area as two other adult Davidians, both of whom died of gunshot wounds of the head. MC 64 and MC 65 were recovered along with a bloody blanket in which there is a defect consistent with a gunshot hole. Both MC 64 and MC 65 have apparent antemortem injuries; however, postmortem changes prevent definitive assessment of the nature of the injuries.

Finally, decomposition and the effects of the fire preclude definitive exclusion of head/torso firearm injuries in 34 individuals (MC 4, 6, 9, 10, 11, 14, 15, 17, 18, 23, 24, 25, 26, 28, 29, 13, 38, 40, 30, 32, 62, 65, 67-1, 67-3, 67-4, 67-6, 59, 64, 51, 74, 61/50, 63, 75, 60). Other Branch Davidian decedents without gunshot wounds of the head/torso conceivably could have gunshot wounds of the extremities that are concealed by the extensive destruction by fire of many of their extremities. Since extremity gunshot wounds are typically (although not necessarily) non-lethal, Branch Davidian decedents having an intact head/torso without evidence of gunshot injury are considered to have most likely died of some other type of injury.

II-3. Fire/Smoke Injuries

Deaths due to fires are most commonly due to smoke inhalation, flame/heat, atmospheric oxygen deficiency and falling debris/structural collapse. In most structural fires smoke inhalation is a prominent cause of disability and mortality. Smoke is a complex mixture of liquid and solid aerosols, fumes, gases and vapors including such potentially injurious substances as carbon monoxide (CO), cyanide (CN), irritating gases, humidity, particulate matter and carbon dioxide, to name but a few.

CO is the product of incomplete combustion of organic fuels and its production is particularly high in smoldering fires, less so in flame combustion, and it may be minimal in certain fires such as flash fires. The amount of carbon monoxide production will also be affected by the efficiency of the burning process and the nature of the materials being burned (i.e., natural vs synthetic). CO is the primary constituent of smoke responsible for death in most structural fires. However, in some fires the other constituents of smoke may play a prominent role in disability and death.

Primary issues in the investigation of a death occurring in relation to a fire involve establishing, when possible: the identity of the decedent, whether or not the decedent was alive during the fire, the cause of death and the presence and/or absence of factors contributing to death, disability and/or hindering the person's ability to escape the fire. Antemortem injuries need to be separated from postmortem injuries related to the fire, fire suppression endeavors and recovery activities.

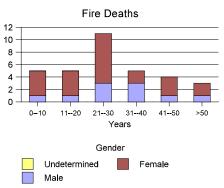
In most decedents whose bodies are recovered from a burned structure, the presence of life during the fire is established by determining that they breathed smoke. The presence of soot in an intact airway past the level of the vocal cords is generally considered evidence of breathing during the fire. Soot in the intact stomach can also be used as an indicator of life since it indicates swallowing. Care must be taken to exclude passive deposition of smoke if the airway or upper digestive tract is not intact.

In most structural fires the presence of CO unaccounted for by other environmental exposure such as tobacco smoking (average CO saturation in a smoker is 6% with heavy smokers having circa 10%) is also indicative of breathing during the fire. Death due to smoke inhalation during a structural fire is usually associated with blood CO saturation in the range of 25-85%. Death may occur at lower CO saturation depending on the constituents of the smoke, other fire-related effects and the presence of other injuries, toxic substances or diseases that may increase a person's susceptibility to the effects of smoke/CO. At sublethal concentrations, CO can also cause debilitation. Blood CO saturation of less than 10% usually does not cause any noticeable effects unless the person has some predisposing condition such as coronary artery disease. Symptoms and signs of CO exposure may become apparent in many people when CO saturation is in excess of 15-20%. However, there is not a predictable correlation between blood CO saturation and symptoms. Most people who breath smoke will have demonstrable soot in the airway and elevated CO in their blood. Exceptions do occur.

Victims of flash fires often have minimal, if any soot, in their airways and do not demonstrate elevated blood CO saturations. Exposure to very high concentrations of atmospheric CO (in excess of 50,000 ppm) can cause death by inducing a cardiac rhythm disturbance prior to significant elevation of the blood CO saturation. Infrequently, elevated CO saturation and smoke deposition are minimal or absent in a victim recovered from a typical structural fire when there is a reliable history or convincing circumstantial evidence that the victim was alive in the burning structure.

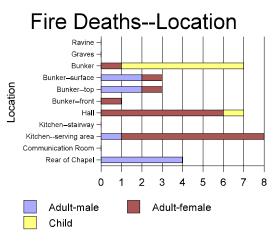
The Branch Davidian complex fire was not a typical structural fire. The fire progression was rapid and involved some fuels not typically present in significant amounts in typical structural fires. The Branch Davidians used accelerants at multiple ignition sites (see OSC expert reports of Dr. Ulf Wickstrom and Mr. Walter Wetherington).

In my evaluation of the Branch Davidian decedents, death is ascribed to the fire when: (1) there is definitive evidence of smoke inhalation (soot in the distal airways or intact stomach) and I believed I could reasonably exclude the presence of some other lethal injury. Due to the apparent effect of decomposition on the analytic process for CO (see toxicology discussion), I do not think a positive CO measured in a markedly decomposed specimen is a reliable indication that the individual was alive and breathing smoke during the fire without other supporting information; (2) where the airways are not able to be assessed for smoke inhalation but CO was reportedly present in the blood/tissue (see toxicology discussion), no other lethal lesion is demonstrable and other lethal lesions are reasonably excluded or there is no compelling evidence to suspect the presence of a lethal injury unrelated to the fire; and, (3) if some other lethal injury cannot be definitively excluded (such as a gunshot wound of the head) and/or smoke inhalation is not able to be assessed due to postmortem burning/decomposition, but the body was recovered in proximity to other definite fire-related deaths and no compelling circumstantial evidence is present to suggest a reasonable likelihood of a different cause of death.



Death is ascribed to fire in 26 adults and 7 children. Among these 33 decedents, 23 (MC 1, 2, 4, 10, 11, 14,16, 17, 18, 19, 25, 26, 27, 12, 37, 42, 30, 32, 49, 52, 54, 71, 67-5/69) have soot deposited in the airway and CO reported in the blood/tissue. Two of the decedents (MC 5, 38) have smoke in the airway, but no CO was detected. Eight of the decedents (MC 9, 23, 24, 28, 29, 72, 73, 70/51A) are reported to have CO, but are not able to be assessed for airway smoke deposition. It is not clear why the two individuals who have soot clearly described in the lung tissue airways, a reliable sign of smoke inhalation,

fail to demonstrate CO in the blood. As noted previously, a variety of circumstances may be associated with this finding.



Fire deaths were recovered from the rear of the chapel (MC 1, 2, 4, 5); kitchen serving area (MC 9, 10, 11, 14, 16, 17, 18, 19); hallway (MC 23, 24, 25, 26, 27, 28, 29); the front (MC 12) and top (MC 37, 38, 42) of the concrete bunker; and, on the surface (MC 30, 32, 49) and in the debris in the concrete bunker (MC 67-5/69, 70/51A, 52, 72, 54, 71, 73). No fire deaths were recovered from the communications room, kitchen stairwell, tornado shelter graves or the ravine.

In some cases, smoke/thermal burns may have hastened death caused by some other injury such as a gunshot wound. In other cases, where the fire did not contribute to death, the presence of non-lethal smoke inhalation

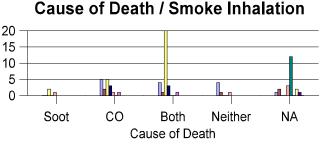
does indicate the decedent was alive during

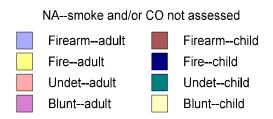
Cause of Death / Smoke Inhalation

Many of the bodies experienced postmortem burning which resulted in extensive distortion, loss of tissues (bone, soft tissue, organs) and bone fractures.

the fire.

The reports of the OSC fire experts indicate the fire was intentionally set from within the complex. There were at least three sites of origin and evidence of the use of accelerants. The manner of death is most appropriately certified as homicide for any death due to the fire itself (smoke





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inhalation, thermal burns) or to its secondary effects (falling debris, falls due to limited visibility, etc) since the fire was arson.

II-4. Blunt Force Injuries

I attributed deaths to blunt force injuries when: (1) the presence of a lethal blunt force injury is demonstrable; or (2) when there are fractures (unrelated to heat or firearm injuries) of a type usually associated with vital organ injuries having significant lethal potential and no evidence of more rapidly lethal injuries. Some of these deaths may have been hastened by the fire.

I attributed four deaths to blunt force injuries. Two of the decedents are adults (MC 3 and MC 13) and two are children (MC 59 and MC 63). The children were recovered from the concrete bunker. Both have head injuries and one also has a chest injury. The cause of the injuries cannot be definitively established. No definitive assessment for smoke inhalation is possible.

One of the adults (MC 3) was found in the rear of stage stairwell with injuries consistent with being received in a fall. MC 3 has evidence of smoke inhalation and also has heart disease. The other adult (MC 13) died of a broken neck . The exact nature of the broken neck is not apparent but could have been the result of a fall or being struck by falling debris. No definitive evidence of smoke inhalation is identified in MC 13.

II-5. Sharp Force Injuries

A single death (MC 33/47B) is attributed to sharp force injury. A 3 year old child, whose remains were found at the surface in the concrete bunker, died of a stab wound to the chest. This wound was inflicted by another person. No definitive evidence of smoke inhalation is present. The autopsy pathologist indicated the possible presence of a minimal amount of soot within severely decomposed lung tissue.

II-6. Explosives

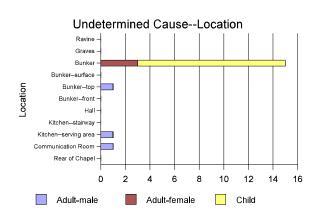
There were no deaths caused by the effects of any explosive device. No evidence of blast injury is seen in any of the Branch Davidian decedents. A small number of Branch Davidian decedents were struck by shrapnel from exploding hand grenades. Fragments of hand grenades were recovered from 7 bodies who were found in the areas of the communications room (MC 6, 7, 8), kitchen/serving area (MC 18), kitchen/stairway (MC 20, 21) and the top of the concrete bunker (MC 40). Although some of these pieces of metal penetrated the soft tissues, there was minimal, if any, hemorrhage associated with these wounds. No injury to any vital organ by hand

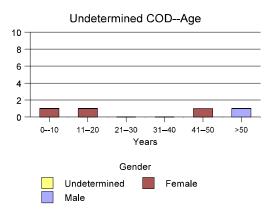
grenade shrapnel is identified. All the grenade fragments appear to have struck the bodies after death. No antemortem grenade injuries are identified. Several Branch Davidian decedents received postmortem injuries from heat-induced explosions ("cooking off") of unchambered ammunition.

II-7. Undetermined Causes of Deaths

The cause of death is listed as undetermined when: (1) there is no apparent injury or disease condition adequate to cause death in a body having all vital organ systems substantially intact; (2) a possible cause of death is present but other potential causes of death cannot be reasonably excluded; and (3) the circumstances indicate a reasonable likelihood that a particular cause of death was operative even though it cannot be scientifically adequately demonstrated due to postmortem damage or decomposition.

In all, 18 deaths are listed as being due to undetermined causes. The effects of decomposition and fire prevented a cause of death determination of these persons. Of these, 6 are adults (MC 6, 15, 40, 51, 75, 67-3) and 12 are children (MC 55, 57, 60, 61/50, 74, 62, 64, 65, 67-1, 67-2, 67-4, 67-6). Fifteen of the 18 were found in the concrete bunker. For a detailed discussion of each of these deaths please refer to the particular case summaries.





II-8. Suffocation/Smothering/Overlaying

The Tarrant County Medical Examiner's Office attributed the deaths of 10 individuals to smothering/suffocation/overlaying (MC #s 51, 51A, 55, 57, 61, 62, 67-2, 67-3, 67-4 and 70). A non-OSC consultant pathologist ascribed the deaths of 6 persons to "suffocation rather than fire" (MC #s 55, 67-2, 67-6, 70, 75 and "Isiah Martinez." It is likely that the "Isiah Martinez" referred to by this non-OSC consultant pathologist is actually Crystal Martinez because the body of Crystal Martinez was initially misidentified as being Isaiah Martinez. DNA studies have identified MC 57 as Crystal Martinez and MC 53 as Isaiah Martinez.) Each of these bodies was recovered from the concrete bunker. Based upon the information that is currently available, I do not believe these deaths can be demonstrated with reasonable certainty to be included in this causation group. I believe two of these cases, certified by the medical examiner, represent a single person (MC 51A and MC 70). When these remains are combined, the cause of death of this person (MC 51A/70) can be attributed to smoke inhalation/thermal burns. I believe the rest of these cases (MC 51, 55, 57, 61, 62, 67-2, 67-3, 67-6 and 75) lack sufficient information to establish a specific cause of death and I think are best certified as undetermined.

To make the diagnosis of suffocation/smothering/overlaying in deaths occurring under the circumstances encountered at the Branch Davidian complex requires reasonably excluding other causes of death. The condition of most of the remains does not allow adequate exclusion of other potentially lethal injuries such as gunshot wounds, smoke inhalation/thermal burns or blunt trauma. Other bodies found in proximity to these bodies demonstrate evidence of other lethal injuries (gunshot wounds, blunt force injuries and smoke inhalation/thermal burns). One of the bodies (MC 57) shows evidence of some smoke inhalation (small amount of soot) but no toxicologic data is available and no other injury is apparent. Another body (MC 55) had a moderate amount of clotted blood involving the lower right chest and no respiratory structures sufficient to examine for soot deposition. However, the possibility that some of the deaths are due to suffocation/smothering/overlaying cannot be categorically excluded. It is not likely that falling material from the ceiling caused widespread compression asphyxia. It is my understanding that the fallen ceiling material was limited and dislodged at a very late stage of and after the fire. Due to the characteristics of the fire, I would expect the occupants of the room to be dead of smoke inhalation and/or thermal burns prior to fire-induced collapse of significant areas of the ceiling.

II-9. Toxicology

Comprehensive screening for ethanol, CO, and a variety of other potentially toxic substances was performed by the TCMEO when samples could be obtained. Sampling was affected by the effects of fire and decomposition. Analysis was affected by decomposition.

There is no evidence of any mass ingestion of a toxic substance such as occurred at Jonestown. Many samples did contain cyanide and/or ethanol. The ethanol is consistent with postmortem production during decomposition. The cyanide is consistent with decomposition and/or smoke inhalation.

CO is normally present in low concentration in the blood (saturation <1%). Increased blood CO saturation most commonly results from exposure to atmospheric CO which is a product of incomplete combustion of organic materials. CO is a major component of smoke produced during structural fires. Atmospheric CO is not passively absorbed by a dead body in a fire, but requires active breathing to be inhaled into the lungs where it is transferred to the blood and binds to (saturates) the oxygen-carrying molecules (hemoglobin) in red blood cells. On occasion, elevated blood CO saturation is the result of exposure to a substance such as dichloromethane which forms CO in the body as it is metabolized.

The amount of CO in the blood is generally measured as the percent of the hemoglobin in the blood that is bound to (saturated by) CO. Tissue measurements of CO saturation reflect the red blood cell content within the tissues as well as any binding of CO to hemoglobin-like molecules that are present in the tissues (such as myoglobin in muscle tissue). Care must be taken when interpreting laboratory measurements of CO concentration to consider the possibility that the reported test values do not accurately reflect the true blood/tissue CO concentration in the body during life, but are erroneous due to some interfering factor in the analyzed specimen such as may occur with decomposition. These erroneous values occur even when the analytic procedure has technically been performed correctly and may be either higher or lower than the true value (false positive or false negative value, respectively). The elevated blood/tissue CO saturations reported by the TCMEO laboratory are consistent with smoke inhalation, inhalation or metabolic production of CO from some other source and/or the effects of decomposition on the analytic process. I do not see any evidence of any primary or secondary source of exposure that would cause a significant antemortem elevation of CO saturation except for the fire. Decomposition affects the interpretation of reported positive CO values. A variety of changes that occur during decomposition may interfere with some analytic techniques for CO and result in false positive results.

The analysis of the samples from the Branch Davidians involved the use of a spectrophotometer having a direct numerical readout. This methodology is commonly used to measure CO but is susceptible to interference by decomposition and may yield false positive results. The decomposition effects are inconsistent and inconstant, but I would expect them to be more pronounced as decomposition becomes more advanced. Mild-moderate decompositional changes probably would not significantly affect the analysis of blood. However, the apparent detection of CO in blood samples that are markedly decomposed is not definitive evidence of antemortem smoke (or other CO source) inhalation. Interpretation of CO content of tissues that do not have molecules that avidly bind CO (such as myoglobin in skeletal muscle) is dependent on the amount of blood within the tissue. Loss of blood from these tissues, inherent analytic interference by the tissues and decomposition related analytic interference make interpretation of decomposed tissue CO saturation especially difficult. Destruction of oxygen/CO binding compounds during decomposition can result in false negative analyses.

The effect of decomposition on CO analysis in the Branch Davidian samples is illustrated by cases MC 78 and MC 80. These two persons were recovered from the concrete tornado shelter grave sites and were decomposed to the extent that blood samples could not be obtained and liver tissue was submitted for analysis. MC 78 and MC 80 had been killed by gunfire nearly two months prior to the fire. In addition, there is no evidence to suggest that they were exposed to a non-fire CO source that would account for significant antemortem CO elevations. The reported CO saturations of these two individuals are 43% (liver) and 52% (liver). These analytic results appear to be false positive values caused by the effects of decomposition on the analyses. It should be noted that the demonstrably false positive CO measurements are restricted to analyses of visceral organ tissues such as liver. Demonstrably false positive analyses of samples of blood are lacking. Analyses of blood samples recovered from the other buried bodies were reported as "negative" for CO.

Since some of the samples submitted to the laboratory from the Branch Davidian decedents consisted of tissues other than blood and exhibited significant decomposition, reportedly positive CO values involving these specimens must be interpreted with great caution. CO analyses performed on organ and liquefied decomposed tissue specimens are likely not reliable and more than the usual reliance needs to be placed on other corroborative information to prevent misinterpretation of decomposition-related false positive CO values. CO analyses of samples grossly recognizable as blood are likely reasonably reliable. For these reasons, I would explicitly qualify the opinion of the non-OSC consultant forensic pathologist, who states that a CO saturation of >5% indicates the person was alive and breathing during the fire, by adding that the detected CO must accurately reflect an antemortem elevated CO saturation and not be an analytic artifact. I agree with this expert's statement that a decedent with soot in the respiratory passages (assuming an intact airway and soot deposition distal to the vocal cords) can be "safely assumed to have been at least breathing at some point during the fire and in contact with its carbonaceous residues."

The TCMEO also conducted specific analyses for CS and its hydrolytic products. None

of these compounds were identified. The available circumstantial and physical/chemical evidence does not support the presence of death due to CS exposure.

II-10. Manner of Death

The manner of death is a classification of death made on the basis of the type of condition that caused death and the circumstances under which the condition occurred. The manners of death include natural, accident, homicide and suicide. In addition, the manner of death may be certified as "undetermined" if the available information does not allow a particular manner of death to be determined. It should be noted that homicide, the killing of one individual by another through a volitional act, may or may not involve contravention of the criminal code.

The deaths of all but possibly two of the six Davidians killed on February 28, 1993, are homicides. It can be determined that four of these people (MC 76, 78, 79, 81) were killed by gunshots fired by other persons and thus are homicides. One person (MC 77) was probably shot by some other Davidian, but a self-inflicted gunshot wound cannot be excluded. MC 77 is probably a homicide but suicide cannot be ruled out. MC 80 died of an intraoral gunshot wound that is very characteristic of a self-inflicted injury (suicide); however, surviving Davidians have indicated that he may have been killed by another Davidian (homicide).

Among the deaths that occurred in the burning structure, several are homicides because they were caused by injuries inflicted by other Davidians. The manner of death of anyone succumbing from the effects of the fire, either directly or indirectly, is homicide because the origin of the fire was arson, i.e. it was deliberately started by other Davidians.

Many of the deaths of undetermined causes, including those of the young children, are homicides because there are no other reasonable alternatives for these deaths except the fire or at the hands of another individual. As previously discussed, some of the deaths of undetermined causation may have been caused by suicidal or homicidal gunshots that postmortem changes prevent from being identified.

The firearm deaths that occurred on April 19, 1993, include homicides and, most likely, some suicides. At least eleven of these deaths were at the hands of other Davidians and thus are homicides. Insufficient information is available to determine if the wounds of three Davidians could have been self-inflicted (suicide) or whether they were received at the hands of another person (homicide). There are six persons with gunshot wounds that are consistent with being self-inflicted (suicide); however, as discussed previously, infliction by other Davidians cannot be excluded (homicide).

$\textbf{III-1A. Davidian Decedents-Alphabetical listing} \ \textit{(children-italics)}$

<u>Name</u>	<u>MC#</u>	Cause of Death	<u>Page</u>
Andrade, Chanel	62	Undetermined	126
Andrade, Jennifer	12	Smoke inhalation, thermal burns	81
Andrade, Katherine	30	Smoke inhalation, thermal burns	96
Bennett, Alrick	37	Smoke inhalation, thermal burns	87
Benta, Susan	23	Smoke inhalation, thermal burns	74
Blake, Winston	77	Gunshot wound of head	137
Borst, Mary Jean	45	Gunshot wounds of head and chest/abdome	n 65
Cohen, Pablo	42	Smoke inhalation, thermal burns	95
Davies, Adebowala	15	Undetermined	58
Doyle, Shari	35	Gunshot wound of head	85
Elliott, Beverly	29	Smoke inhalation, thermal burns	80
Fagan, Doris	27	Smoke inhalation, thermal burns	78
Fagan, Yvette	25	Smoke inhalation, thermal burns	76
Farris, Lisa	43	Gunshot wound of head	63
Friesen, Raymond	1	Smoke inhalation, thermal burns	43
Gent, Pages	64	Undetermined	127
Gent, Peter	76	Gunshot wound of chest	146

<u>Name</u>	<u>MC#</u>	Cause of Death	<u>Page</u>
Hardial, Sandra	17	Smoke inhalation, thermal burns	60
Henry, Diana	18	Smoke inhalation, thermal burns	61
Henry, Vanessa	16	Smoke inhalation, thermal burns	59
Henry, Phillip	22	Gunshot wounds of chest and head	72
Henry, Stephen	21	Gunshot wound of head	70
Henry, Zilla	28	Smoke inhalation, thermal burns	79
Hipsman, Novelette	39	Gunshot wound of head	90
Hipsman, Peter	79	Gunshot wounds of head	141
Houtman, Floyd	3	Blunt force injuries-chest	46
Howell, Cyrus	67-2	Undetermined	131
Howell, Rachel	67-3	Undetermined	132
Howell, Star	67-1	Undetermined	130
Jewell, Sherry	11	Smoke inhalation, thermal burns	56
Jones, David	36	Gunshot wound of head	86
Jones, Perry	80	Gunshot wound of head	144
Jones, Serenity	72	Smoke inhalation, thermal burns	119
Jones twin	63	Blunt force injuries-head	116
Jones twin	73	Smoke inhalation, thermal burns	120
Koresh (Howell), Bobbie	67-5/6	9 Smoke inhalation, thermal burns	134
Koresh, David (aka Howell, Vernon)	8	Gunshot wound of head	52

<u>Name</u>	<u>MC#</u>	Cause of Death	<u>Page</u>
Little, Dayland	33/471	B Stab wound of chest	102
Little, Jeffrey	44	Gunshot wound of chest	64
Little (nee Gent), Nicole	47	Shotgun wound of head	103
Little, fetus (Nicole)	47C	Maternal injury (shotgun wound)	103
Malcolm, Livingston	2	Smoke inhalation, thermal burns	45
Martin child	26	Smoke inhalation, thermal burns	77
Martin child	61/50	Undetermined	115
Martin, Daisy	13	Blunt force injuries-neck	82
Martin, Douglas	5	Smoke inhalation, thermal burns	48
Martin, Wayne	49	Smoke inhalation, thermal burns	104
Martinez, Abigail	56	Gunshot wound of head	111
Martinez, Audrey	55	Undetermined	110
Martinez, Crystal	57	Undetermined	113
Martinez, Isaiah	53	Gunshot wound of chest	108
Martinez, Joseph	52	Smoke inhalation, thermal burns	107
Martinez, Juliet	54	Smoke inhalation, thermal burns	109
McBean, John	32	Smoke inhalation, thermal burns	101
Monbelly, Allison	24	Smoke inhalation, thermal burns	75
Morrison, Melissa	74	Undetermined	121
Morrison, Rosemary	75	Undetermined	122
Murray, Sonia	10	Smoke inhalation, thermal burns	55

<u>Name</u>	<u>MC#</u>	Cause of Death	<u>Page</u>
Nobrega, Beryl Teresa	19	Smoke inhalation, thermal burns	62
Riddle, James	20	Gunshot wound of head	68
Saipaia, Rebecca	38	Smoke inhalation, thermal burns	89
Schneider, Judy	51	Undetermined	105
Schneider, Mayanah	70/51A	Smoke inhalation, thermal burns	117
Schneider, Steven	7	Gunshot wound of head	50
Schroeder, Michael	81	Gunshot wounds of head, chest, abdomen	147
Sellors, Clifford	9	Smoke inhalation, thermal burns	54
Sonobe, Florecita	34	Gunshot wound of head	84
Sonobe, Scott	4	Smoke inhalation, thermal burns	47
Summers, Aisha	31A	Gunshot wound of chest	97
Summers, fetus (Aisha)	31B/58	3 Maternal injury (gunshot wound)	97
Summers, Gregory	40	Undetermined	92
Sylvia, Hollywood	67-4	Undetermined	133
Sylvia, Lorraine	66	Gunshot wounds of chest	129
Sylvia, Rachel	67-6	Undetermined	135
Thibodeau, Michelle (nee Jones)	71	Smoke inhalation, thermal burns	118
Unidentified	31DE	Gunshot wound of head	99
Unidentified	59	Blunt force injuries-head	124
Unidentified	60	Undetermined	114
Unidentified	65	Undetermined	128

<u>Name</u>	<u>MC#</u>	Cause of Death	<u>Page</u>
Unidentified	67-7/67-8	Gunshot wound of head	136
Vaega, Margarida	14	Smoke inhalation, thermal burns	57
Vaega, Neru Neil	41	Gunshot wound of head	93
Wendel, Jaydean	78	Gunshot wound of head	140
Wendel, Mark	6	Undetermined	49

III 1B.--Davidian Decedents--MC # listing (children-italics)

<u>MC#</u>	Name Cause of Death		Page	
1	Friesen, Raymond	Smoke inhalation, thermal burns	43	
2	Malcolm, Livingston	Smoke inhalation, thermal burns	45	
3	Houtman, Floyd	Blunt force injuries-chest	46	
4	Sonobe, Scott	Smoke inhalation, thermal burns	47	
5	Martin, Douglas	Smoke inhalation, thermal burns	48	
6	Wendel, Mark	Undetermined	49	
7	Schneider, Steven	Gunshot wound of head	50	
8	Howell, Vernon (aka Koresh, David)	Gunshot wound of head	52	
9	Sellors, Clifford	Smoke inhalation, thermal burns	54	
10	Murray, Sonia	Smoke inhalation, thermal burns	55	
11	Jewell, Sherry	Smoke inhalation, thermal burns	56	
12	Andrade, Jennifer	Smoke inhalation, thermal burns	81	
13	Martin, Daisy	Blunt force injuries-neck	82	
14	Vaega, Margarida	Smoke inhalation, thermal burns	57	
15	Davies, Adebowalo	Undetermined	58	
16	Henry, Vanessa	Smoke inhalation, thermal burns	59	
17	Hardial, Sandra	Smoke inhalation, thermal burns	60	
18	Henry, Diana	Smoke inhalation, thermal burns	61	

<u>MC#</u>	Name Cause of death		
19	Nobrega, Beryl Teres	a Smoke inhalation, thermal burns	62
20	Riddle, James	Gunshot wound of head	68
21	Henry, Stephen	Gunshot wound of head	70
22	Henry, Phillip	Gunshot wounds of head and chest	72
23	Benta, Susan	Smoke inhalation, thermal burns	74
24	Monbelly, Allison	Smoke inhalation, thermal burns	75
25	Fagan, Yvette	Smoke inhalation, thermal burns	76
26	Martin child	Smoke inhalation, thermal burns	77
27	Fagan, Doris	Smoke inhalation, thermal burns	78
28	Henry, Zilla	Smoke inhalation, thermal burns	79
29	Elliott, Beverly	Smoke inhalation, thermal burns	80
30	Andrade, Katherine	Smoke inhalation, thermal burns	96
31A	Summers, Aisha	Gunshot wound of chest	97
31B/58	8 Summers, fetus (Aish	na) Maternal injury (gunshot wound)	97
31DE	Unidentified	Gunshot wound of head	99
32	McBean, John	Smoke inhalation, thermal burns	101
33/47E	3 Little, Dayland	Stab wound of chest	102
34	Sonobe, Florecita	Gunshot wound of head	84
35	Doyle, Shari	Gunshot wound of head	85
36	Jones, David	Gunshot wound of head	86

<u>MC#</u>	<u>Name</u>	Cause of death	<u>Page</u>
37	Bennett, Alrick	Smoke inhalation, thermal burns	87
38	Saipaia, Rebecca	Smoke inhalation, thermal burns	89
39	Hipsman, Novellette	Gunshot wound of head	90
40	Summers, Gregory	Undetermined	92
41	Vaega, Neru Neil	Gunshot wound of head	93
42	Cohen, Pablo	Smoke inhalation, thermal burns	95
43	Farris, Lisa	Gunshot wound of head	63
44	Little, Jeffrey	Gunshot wound of chest	64
45	Borst, Mary	Gunshot wounds of head and chest/abdomen	65
46	Human bone	(No further information)	67
47	Little (nee Gent), Nic	ole Shotgun wound of head	103
47C	Little, fetus (Nicole)	Maternal injury (shotgun wound)	103
49	Martin, Wayne	Smoke inhalation, thermal burns	104
50/61	Martin child	Undetermined	
51	Schneider, Judy	Undetermined	105
51A/70) Schneider, Mayannal	h Smoke inhalation, thermal burns	117
52	Martinez, Joseph	Smoke inhalation, thermal burns	107
53	Martinez, Isaiah	Gunshot wound of chest	108
54	Martinez, Juliet	Smoke inhalation, thermal burns	109
55	Martinez, Audrey	Undetermined	110
56	Martinez, Abigail	Gunshot wound of head	111

<u>MC#</u>	<u>Name</u>	Cause of death	<u>Page</u>
57	Martinez, Crystal	Undetermined	113
59	Unidentified	Blunt force injuries-head	124
60	Unidentified	Undetermined	114
61/50	Martin child	Undetermined	115
62	Andrade, Chanel	Undetermined	126
63	Jones twin	Blunt force injuries-head	116
64	Gent, Pages	Undetermined	127
65	Unidentified	Undetermined	128
66	Sylvia, Lorraine	Gunshot wounds of chest	129
67-1	Howell, Star	Undetermined	130
67-2	Howell, Cyrus	Undetermined	131
67-3	Koresh (Howell), Rac	chel Undetermined	132
67-4	Sylvia, Hollywood	Undetermined	133
67-5/6	9 Koresh (Howell), Bo	bbie Smoke inhalation, thermal burns	134
67-6	Sylvia, Rachel	Undetermined	135
67-7/7	-8 Unidentified	Gunshot wound of head	136
70/51/	A Schneider, Mayannal	n Smoke inhalation, thermal burns	117
71	Thibodeau, Michelle (nee Jones)	Smoke inhalation, thermal burns	118
72	Jones, Serenity	Smoke inhalation, thermal burns	119
73	Jones twin	Smoke inhalation, thermal burns	120

<u>MC#</u>	<u>Name</u>	Cause of death	<u>Page</u>
74	Morrison, Melissa	Undetermined	121
75	Morrison, Rosemary	Undetermined	122
76	Gent, Peter	Gunshot wound of chest	146
77	Blake, Winston	Gunshot wound of head	137
78	Wendel, Jaydean	Gunshot wound of head	140
79	Hipsman, Peter	Gunshot wounds of head	141
80	Jones, Perry	Gunshot wound of head	142
81	Schroeder, Michael	Gunshot wounds of head, chest, abdomen	143

III-1C. Davidian Decedents—Children (up to 18 years of age) (including 2 fetuses)

Name Andrade, Chanel	<u>MC</u> 62	Age (yrs)	<u>Gender</u> F	Cause of death Undetermined
Doyle, Shari	35	18	F	Gunshot wound of head
Gent, Pages	64	1	F	Undetermined
Howell, Cyrus	67-2	8	M	Undetermined
Howell, Star	67-1	5-6	F	Undetermined
Jones, Serenity	72	4-5	F	Smoke inhalation, thermal burns
Jones twin	63	1 ½	F	Blunt injuries
Jones twin	73	1 ½	F	Smoke inhalation, thermal burns
Koresh (Howell), Bobbie	67-5/69	1	F	Undetermined
Little, Dayland	33/47B	3	M	Stab wound of chest
Martin child	26	Teen	F	Smoke inhalation, thermal burns
Martin child	61/50	Teen	F	Undetermined
Martinez, Abigail	56	11	F	Gunshot wound of head
Martinez, Audrey	55	13	F	Undetermined
Martinez, Crystal	57	6	F	Undetermined
Martinez, Isaiah	53	5 ½- 6 ½	M	Gunshot wound of chest

<u>Name</u>	<u>MC#</u>	<u>Age</u>	<u>Gender</u>	Cause of death.
Martinez, Joseph	52	8	M	Smoke inhalation, thermal burns
Morrison, Meliss	a74	6	F	Undetermined
Schneider, Mayar	nnah70/51A 2 !	½-3 ½	F	Smoke inhalation, thermal
Summers, Aisha	31A	17	F	burns Gunshot wound of chest
Sylvia, Hollywoo	od 67-4	1-2	F	Undetermined
Sylvia, Rachel	67-6	13	F	Undetermined
Thibodeau, Mich	elle 71	18	F	Smoke inhalation, thermal burns
Unidentified	31DE	11-14	_	Gunshot wound of head
Unidentified	59	14-19	F	Blunt force injuries
Unidentified	60	2-5	_	Undetermined
Unidentified	65	1 ½-2 ½	F	Undetermined
Unidentified	67-7/67-8	1 1/12	_	Gunshot wound of head
Little fetus	47C	16-18 weeks gest	ation	Maternal injury
Summers fetus	31B/58	8 ½ –9 months go	estation	Maternal injury

III-1D. Davidian Decedents-Listing by cause of death (children-italics)

Firearm Injuries (26)

Name	<u>MC#</u>	Location
Blake, Winston	77	Concrete tornado shelter
Borst, Mary Jean	45	Kitchen/serving area
Doyle, Shari	35	Top of concrete bunker
Farris, Lisa	43	Kitchen/serving area
Gent, Peter	76	Front of complex grave
Henry, Phillip	22	Kitchen/stairway
Henry, Stephen	21	Kitchen/stairway
Hipsman, Novelette	39	Top of concrete bunker
Hipsman, Peter	79	Concrete tornado shelter
Jones, David	36	Top of concrete bunker
Jones, Perry	80	Concrete tornado shelter
Koresh, David (aka Howell, Vernon)	8	Communications room
Little, Jeffrey	44	Kitchen/serving area
Little (nee Gent), Nicole	47	Concrete bunker surface
Martinez, Abigail	56	Concrete bunker
Martinez, Isaiah	53	Concrete bunker
Riddle, James	20	Kitchen/stairway

<u>Name</u>	<u>MC#</u>	Location
Schneider, Stephen	7	Communication room
Schroeder, Michael	81	Ravine
Sonobe, Florecita	34	Top of concrete bunker
Summers, Aisha	31A	Concrete bunker surface
Sylvia, Lorraine	66	Concrete bunker
Unidentified	31DE	Concrete bunker surface
Unidentified	67-7/6	7-8 Concrete bunker
Vaega, Neru Neil	41	Top of concrete bunker
Wendell, Jaydean	78	Concrete tornado shelter

Smoke inhalation/thermal burns (33)

Andrade, Jennifer	12	Front of concrete bunker
Andrade, Katherine	30	Concrete bunker surface
Bennett, Alrick	37	Top of concrete bunker
Benta, Susan	23	Hallway
Cohen, Pablo	42	Top of concrete bunker
Elliott, Beverly	29	Hallway
Fagan, Doris	27	Hallway
Fagan, Yvette	25	Hallway
Friesen, Raymond	1	Stage at rear of chapel
Hardia, Sandra	17	Kitchen/serving area

<u>Name</u>	<u>MC#</u>	Location
Henry, Diana	18	Kitchen/serving area
Henry, Vanessa	16	Kitchen/serving area
Henry, Zilla	28	Hallway
Jewell, Sherry	11	Kitchen/serving area
Jones, Serenity	72	Concrete bunker
Jones twin	73	Concrete bunker
Koresh (Howell), Bobbie	67-5/69	9 Concrete bunker
Malcolm, Livingston	2	Stage stairwell
Martin child	26	Hallway
Martin, Douglas	5	Stage stairwell
Martin, Wayne	49	Concrete bunker surface
Martinez, Joseph	52	Concrete bunker
Martinez, Juliet	54	Concrete bunker
McBean, John	32	Concrete bunker surface
Monbelly, Allison	24	Hallway
Murray, Sonia	10	Kitchen/serving area
Nobrega, Beryl Teresa	19	Kitchen/serving area
Saipaia, Rebecca	38	Top of concrete bunker
Schneider, Mayanah	70/51A	Concrete bunker
Sellors, Clifford	9	Kitchen/serving area
Sonobe, Scott	4	Stage stairwell

<u>Name</u>	<u>MC#</u>	Location
Thibodeau, Michelle (nee Jones)	71	Concrete bunker
Vaega, Margarida	14	Kitchen/serving area
		Blunt Force Injuries (4)
Houtman, Floyd	3	Stage stairwell
Jones twin	63	Concrete bunker
Martin, Daisy	13	Front of concrete bunker
Unidentified	59	Concrete bunker
	<u>,</u>	Sharp Force Injuries (1)
Little, Dayland	33/471	B Concrete bunker surface
	<u>I</u>	<u>Undetermined (18)</u>
Andrade, Chanel	62	Concrete bunker
Davies, Adebowala	15	Kitchen/serving area
Gent, Pages	64	Concrete bunker
Howell, Cyrus	67-2	Concrete bunker

67-3

67-1

55

Howell, Rachel

Howell, Star

Martin child

Martinez, Audrey

Concrete bunker

Concrete bunker

Concrete bunker

61/50 Concrete bunker

<u>Name</u>	<u>MC#</u>	Location
Martinez, Crystal	57	Concrete bunker
Morrison, Melissa	74	Concrete bunker
Morrison, Rosemary	75	Concrete bunker
Schneider, Judy	51	Concrete bunker
Summers, Gregory	40	Top of concrete bunker
Sylvia, Hollywood	67-4	Concrete bunker
Sylvia, Rachel	67-6	Concrete bunker
Unidentified	60	Concrete bunker
Unidentified	65	Concrete bunker
Wendel, Mark	6	Communication room

III-1E. Decedents-Listing by recovery location of body

(children-italics)

Location	<u>MC#</u>	Name C	Cause of Death
1. Rear of c	hapel (5)		
A. Stage	e(1)–MC 1	Friesen, Raymond	Smoke/thermal burns
B. Stairy	well (4)–MC	2 Malcolm, Livingsto	on Smoke/thermal burns
	MC 3	Houtman, Floyd	Blunt trauma
	MC 4	Sonobe, Scott	Smoke/thermal burns
	MC 5	Martin, Douglas	Smoke/thermal burns
2. Commun	ication R	oom (3)	
	MC 6	Wendel, Mark	Undetermined
	MC 7	Schneider, Steven	Gunshot wound of head
	MC 8	Koresh, David	Gunshot wound of head
		(aka Howell, Vernon)	
3. Kitchen/S	Serving A	rea (12)	
	MC 9	Sellors, Clifford	Smoke/thermal burns
	MC 10	Murray, Sonia	Smoke/thermal burns
	MC 11	Jewell, Sherry	Smoke/thermal burns
	MC 14	Vaega, Margarida	Smoke/thermal burns
	MC 15	Davies, Adebowalo	Undetermined
	MC 16	Henry, Vanessa	Smoke/thermal burns
	MC 17	Hardial, Sandra	Smoke/thermal burns
	MC 18	Henry, Diana	Smoke/thermal burns
	MC 19	Nobrega, Beryl Teresa	Smoke/thermal burns
	MC 43	Farris, Lisa	Gunshot wound of head
	MC 44	Little, Jeffrey	Gunshot wound of chest
	MC 45	Borst, Mary	Gunshot wounds of head and
			chest/abdomen
	MC 46	(bone)	
4. Kitchen/S	Stairway	(3)	
i. IXICHCII/k	MC 20	Riddle, James	Gunshot wound of head
	MC 20 MC 21	Henry, Stephen	Gunshot wound of head
	MC 21 MC 22	Henry, Phillip	Gunshot wounds of head and chest
	IVIC 22	memy, rinnip	Gunshot wounds of flead and chest

5. Hallway (7)

MC 23	Benta, Susan	Smoke/thermal burns
MC 24	Monbelly, Allison	Smoke/thermal burns
MC 25	Fagan, Yvette	Smoke/thermal burns
MC 26	Martin child	Smoke/thermal burns
MC 27	Fagan, Doris	Smoke/thermal burns
MC 28	Henry, Zilla	Smoke/thermal burns
MC 29	Elliott, Beverly	Smoke/thermal burns

6. Front of Concrete bunker (2)

MC 12	Andrade, Jennifer	Smoke/thermal burns
MC 13	Martin, Daisy	Blunt trauma

7. Top of Concrete bunker (9)

MC 34	Sonobe, Florecita	Gunshot wound of head
MC 35	Doyle, Shari	Gunshot wound of head
MC 36	Jones, David	Gunshot wound of head
MC 37	Bennett, Alrick	Smoke/thermal burns
MC 38	Saipaia, Rebecca	Smoke/thermal burns
MC 39	Hipsman, Novellette	Gunshot wound of head
MC 40	Summers, Gregory	Undetermined
MC 41	Vaega, Neru Neil	Gunshot wound of head
MC 42	Cohen, Pablo	Smoke/thermal burns

8. Concrete bunker Surface (7 + 2 fetuses)

MC 30	Andrade, Katherine	Smoke/thermal burns
MC 31A	Summers, Aisha	Gunshot wound of chest
MC 31B/5	8 Summers fetus (Aisha)	Maternal gunshot wound
<i>MC 31DE</i>	Unidentified	Gunshot wound of head
MC 32	McBean, John	Smoke/thermal burns
MC 33/47	B Little, Dayland	Stab wound of chest
MC 47	Little, Nicole	Shotgun wound of head
MC 47C	Little, fetus (Nicole)	Maternal shotgun wound
MC 49	Martin, Wayne	Smoke/thermal burns

9. Concrete bunker (28)

A. Area closest to cooler (12)

MC 62	Andrade, Chanel	Undetermined
MC 65	Unidentified	Undetermined
MC 66	Sylvia, Lorraine	Gunshot wounds of chest
MC 67-1	Howell, Star	Undetermined
MC 67-2	Howell, Cyrus	Undetermined
MC 67-3	Howell, Rachel	Undetermined
MC 67-4	Sylvia, Hollywood	Undetermined
MC 67-5/6	69 Koresh (Howell), Bobbie	Smoke/thermal burns
MC 67-6	Sylvia, Rachel	Undetermined
MC 67-7/0	67-8 Unidentified	Gunshot wound of head
MC 59	Unidentified	Blunt trauma
MC 64	Gent, Pages	Undetermined

B. Concrete bunker–Area furthest from cooler (16)

MC 51	Schneider, Judy	Undetermined
MC 70/51A Schneider, Mayannah Smoke/thermal burns		
MC 52	Martinez, Joseph	Smoke/thermal burns
MC 53	Martinez, Isaiah	Gunshot wound of chest
MC 60	Unidentified	Undetermined
MC 72	Jones, Serenity	Smoke/thermal burns
MC 74	Morrison, Melissa	Undetermined
MC 61/50	Martin child	Undetermined
MC 54	Martinez, Juliet	Smoke/thermal burns
MC 55	Martinez, Audrey	Undetermined
MC 56	Martinez, Abigail	Gunshot wound of head
MC 57	Martinez, Crystal	Undetermined
MC 63	Jones twin	Blunt trauma
MC 71	Thibodeau, Michelle	Smoke/thermal burns
	(nee Jones)	
MC 73	Jones twin	Smoke/thermal burns
MC 75	Morrison, Rosemary	Undetermined

10. Concrete tornado shelter (4)

MC 77	Blake, Winston	Gunshot wound of head
MC 78	Wendel, Jaydean	Gunshot wound of head
MC 79	Hipsman, Peter	Gunshot wounds of head
MC 80	Jones, Perry	Gunshot wound of head

11. Front of complex grave (1) MC 76 Gent, Peter

AC 76 Gent, Peter Gunshot wound of chest

12. Ravine (1)

MC 81 Schroeder, Michael Gunsl

Gunshot wounds of head, chest and

abdomen

III-2. Specific location and case synopsis and comments

III-2A. Listing by Location of Davidian Remains (children-italics)

This section of the report includes an overview of the remains found in each particular location followed by a synopsis and discussion of information pertinent to each decedent.

The case synopses include descriptions of the general characteristics of each body; the presence of significant diseases, antemortem injuries and postmortem changes (injuries and decomposition); results of pertinent laboratory analyses including those from the toxicology and crime laboratories; a brief analysis of the information; and, my opinion as to the cause and manner of death. In some cases, I also address issues raised by other individuals who have made statements about particular decedents.

Rear of chapel–Stage (MC 1) and Stairwell (MC 2 – MC 5)

There were five men found in the area of the rear of the chapel. One was found in the area of the stage and the others were found at the stairwell. All of the men exhibit evidence of smoke inhalation. Three died of smoke inhalation/thermal burns and the other died primarily of blunt force chest injury with possible contribution by heart disease and smoke inhalation. Firearms were found in proximity to each of these individuals. No firearms injuries were identified in any of these men.

MC 1- Raymond Friesen

Mr. Friesen, a 76 year old White man (DOB 7/14/16), was found alone in the area of the stage at the rear of the chapel. A charred rifle barrel lays vertically along the right anterolateral torso. The body is charred but the tissues and organs are well-preserved.

There is evidence of smoke inhalation. The airway is intact. There is a large amount of soot deposited in the large and small airways. The lungs demonstrate profuse congestion and edema. The blood CO saturation is reported as 66%.

There is global charring with heat fractures of the skull. Heat fractures and loss of tissues of the extremities are also present.

Natural disease processes include enlargement of the left ventricle of the heart (left ventricular hypertrophy), arteriosclerotic severe narrowing of the left anterior descending coronary artery (75-80%), aortic moderate atherosclerosis, renal small vessel arteriosclerosis and benign enlargement of the prostate gland.

There is no evidence of a gunshot wound. No wound tracks are identified involving the reconstructed skull, brain or chest/abdominal organs. No collections of blood are found within the body cavities. The anthropology examination demonstrates two perforations of the anterior surface of the chest in the region of each first rib. However, as noted previously, no evidence of any wound track through the body is found. These surface defects do not represent antemortem gunshot wounds.

The toxicology report indicates the presence of benzene. Benzene is a component of a variety of petroleum products including gasoline and paint remover. Exposure to one of these substances or a similar product may have been the source of the benzene identified in the blood.

Conclusion: The presence of soot in the airway past the level of the vocal cords and the elevated blood CO saturation are indicative of smoke inhalation. The extent of smoke inhalation is sufficient to have been lethal. His pre-existing heart disease due to longstanding atherosclerosis (hardening of the arteries) and hypertension (high blood pressure) would enhance the lethal potential of smoke inhalation. However, his blood CO saturation was elevated to the extent that death would be likely in a person without heart disease. Other lethal injuries can be reasonably excluded.

Cause of death: Smoke Inhalation, thermal burns.

Manner of death: Homicide.

MC 2– Livingston Malcolm

Mr. Malcolm, a 26 year old Black man (DOB 5/16/66), was found in the area of the stairwell at the rear of the chapel. A burned rifle and a crow bar were adjacent to the body. He was found in the proximity of three other men, all of whom had evidence of smoke inhalation. Two of these men died of smoke inhalation/thermal burns and the other died of blunt chest injuries.

The preservation of the body is good. The vascular intima is stained by hemoglobin.

There is evidence of smoke inhalation. The airways in the lungs contain a large amount of soot. The lungs are markedly congested and edematous. The blood CO saturation is reported as 26%.

There is global charring with tissue loss and fire-related fractures. Portions of the extremities are absent.

There is no evidence of a gunshot wound. No gunshot wound track was found involving the internal organs or reconstructed skull.

Toxicologic evaluation demonstrates the presence of cyanide in the blood (0.04 mcg/ml). The source of the cyanide can be decomposition and/or inhaling products of combustion.

Mr. Malcolm was repatriated to the UK where his body was re-examined by a team of UK officials. The UK examination indicates the amount and condition of the tissue precludes evaluation of the cause of death, confirming smoke inhalation or excluding the presence of a gunshot wound.

Conclusion: The presence of smoke in the airway past the level of the vocal cords and the presence of an elevated blood CO saturation are indicative of smoke inhalation. No potentially lethal injuries unrelated to the fire are identified.

Cause of death: Smoke Inhalation, thermal burns.

Manner of death: Homicide.

MC 3-Floyd Houtman

Mr. Houtman, a 61 year old Black man (DOB 11/26/31), was recovered from the stairway at the rear of the chapel. A rifle stock was adjacent to the body. He was found in the proximity of three other men, all of whom had evidence of smoke inhalation. Two of these men died of smoke inhalation/thermal burns and the other died of blunt chest injuries.

Moderate decomposition is present.

There is blunt force injury to the chest. The posterior right 4-6 ribs are fractured. A "considerable amount" of clotted blood is present in the right chest cavity. The exact nature of the blunt force injury is not apparent.

There is evidence of smoke inhalation. The proximal trachea is absent due to fire. The distal trachea, mainstem bronchi and intrapulmonic airways contain a small amount of soot. The blood CO saturation is reported as 3.75%.

There is global charring with absence of the lower extremities, pelvis and portions of the skull.

Natural disease processes include arteriosclerotic severe narrowing of the coronary arteries (left anterior descending coronary artery narrowing 95% and right coronary artery narrowing 85%). The left ventricle of the heart is probably heavier than normal (hypertrophic).

No evidence of a gunshot wound is seen.

Toxicologic evaluation demonstrates the presence of cyanide (0.16 mcg/ml) in the blood. The source of the cyanide can be decomposition and/or inhaling products of combustion.

Conclusion: His chest injury was sustained while he was alive as evidenced by the "considerable quantity" or "significant quantity" of clotted blood in his right chest cavity. The presence of smoke in the portions of the airway within the lung tissue indicates smoke inhalation. His pre-existing heart disease would make him more susceptible to the asphyxiating effects of smoke inhalation as well as to the effects of the chest injury. The fire most likely played some role in his death, either being a factor in his sustaining the chest injury or via smoke inhalation.

Cause of Death: The major factor in causing death is the blunt injury to the right chest. Arteriosclerotic heart disease and smoke inhalation may have contributed to his death.

Manner of Death: Homicide.

MC 4-Scott Sonobe

Mr. Sonobe, a 36 year old Asian man (DOB 11/26/57), was recovered from the area of the stairwell at the rear of the chapel. Two handguns were adjacent to the body. He was found in the proximity of three other men, all of whom had evidence of smoke inhalation. Two of these men died of smoke inhalation/thermal burns and the other died of blunt chest injuries.

There is evidence of smoke inhalation. The proximal airway is absent due to fire. The distal trachea and mainstem bronchi contain a mild-moderate amount of soot. The blood CO saturation is reported as 15%.

There is global charring. Heat fractures are present. Most of the extremities are absent. There is extensive destruction of the chest and abdomen including the portions of the viscera. The heart is relatively intact and shows no evidence of injury.

No firearm injuries are identified. A firearm injury involving the chest/abdomen cannot be definitively excluded due to the effects of the fire.

Toxicologic evaluation demonstrates the presence of cyanide (0.32 mcg/ml) in the blood. The source of the cyanide can be decomposition and/or inhaling products of combustion.

Conclusion: The cause of death is indicated by the evidence of soot deposition coupled with the lack of any other lethal injury unrelated to the fire.

Cause of Death: Smoke inhalation, thermal burns.

Manner of Death: Homicide.

MC 5-Douglas Martin

Mr. Martin is a 42 year old Black man (DOB unknown) who was found in the area of the stairway at the rear of the chapel. A rifle and handgun were adjacent to the body. He was found in the proximity of three other men, all of whom had evidence of smoke inhalation. Two of these men died of smoke inhalation/thermal burns and the other died of blunt chest injuries. Mr. Martin's daughters were found in the area of the hallway (MC 26) and concrete bunker (MC 50/61).

There is evidence of smoke inhalation. The proximal trachea is absent due to fire. A 4 inch segment of distal trachea, mainstem bronchi and the portions of the airway within the lung tissue contain soot and debris. The esophagus and stomach are intact and contain soot/debris. No CO is reported in the blood.

There is global charring. Much of the extremities and torso are absent. The viscera is charred and cooked. Heat fractures are present.

No firearm injuries are identified. The presence of a lethal gunshot involving the head, chest or abdomen can be reasonably excluded even though there is extensive fire damage involving these areas.

Toxicologic evaluation demonstrates the presence of cyanide (0.25 mcg/ml) in the blood and urine (0.60 mcg/ml). The source of the cyanide can be decomposition and/or inhalation of products of combustion.

Conclusion: The soot within the lung tissue and within the stomach indicate smoke inhalation even in the absence of CO in the blood. The reason the blood CO saturation is not elevated is not apparent. There are a number of reasons that smoke inhalation can occur in the absence of elevated blood CO saturation. There are no lethal injuries identified that are unrelated to the fire.

Cause of Death: Smoke inhalation, thermal burns.

Manner of Death: Homicide.

Communication Room

Three men were found in the area of the communication room. Two of these men died of gunshot wounds that could have been self-inflicted. The cause of death of the other man cannot be determined; however, a gunshot wound is a reasonable possibility. Firearms were found in proximity to the bodies. The gunshot wounds were caused by low velocity projectiles and were not caused by the high velocity rifles that were found in this area. These men were struck after death by hand grenade fragments.

MC 6-Mark Wendel

Mr. Wendel, a 37 White man (DOB 11/18/55), was recovered along with 2 other men in the communication room area. The other two men died of gunshot wounds of the head that are consistent with having been self-inflicted.

There is moderate decomposition. Charring is widespread and there is extensive loss of tissue.

There is no evidence of smoke inhalation. No soot is identified in the airway and no carbon monoxide is demonstrated in the blood.

There is extensive fire-related destruction of the head which prevents adequate examination to identify or exclude the presence of an injury unrelated to the fire. A gunshot wound involving the head cannot be excluded.

Two exploded hand grenade magnetic fragments penetrated the front of the stomach. These fragments were not associated with defined wound tracks or with hemorrhage indicating that they penetrated the body after death. Both of the other bodies found in this area also had been struck by grenade fragments after death.

Toxicologic evaluation demonstrates the presence of cyanide (0.56 mcg/ml) in the blood. The source of the cyanide is consistent with decomposition.

Conclusion: The cause of Mr. Wendel's death cannot be determined. I suspect Mr. Wendel died from a gunshot wound of the head. No other cause of death is evident and there is no evidence that Mr. Wendel inhaled smoke. The other men (MC 7 and MC 8) found in this area died of gunshot wounds to the head and both of these men have evidence of smoke inhalation.

Cause of Death: Undetermined.

Manner of Death: Undetermined (Homicide or Suicide).

MC 7-Steven Schneider

Mr. Schneider, a 43 year old White man (DOB10/16/49), was recovered along with 2 other men from the area of the communications room. An assault rifle was adjacent to the body. One of the other men died of a gunshot wound to the head. The cause of death of the other man cannot be determined but a lethal gunshot wound is suspected.

The internal organs are relatively well preserved.

There is a gunshot wound perforating the head. The gun was discharged with the muzzle in the mouth. The entry site is via the posterior palate. The track in this area is obscured by the effects of heat. The bullet passed upward and backward through the base of the skull (sphenoid body demonstrates internal beveling) where there is deposition of soot, brain (including the brainstem) to impact the skull in the upper occipital area and exit through a right parietal externally beveled defect (inner surface 13 mm diameter). The exit site edges are not charred. No bullet fragments are identified. A gunshot primer residue test failed to demonstrate antimony (exact site of sampling not specified). Testing for lead and/or barium was not performed. The wound features are those of a low velocity projectile. The wound was not caused by the assault rifle that was laying adjacent to the body. No other lethal injuries sustained prior to death are identified.

There is generalized charring of the torso along with portions of the skull. The distal extremities are absent as are portions of the chest/abdominal wall. There is focal charring of the viscera. The brain is markedly altered by heat.

No soot is identified in the airway. The blood CO saturation was reported as 35%. It cannot be definitively established that the measured CO saturation accurately reflects the antemortem CO and is not an artifact of decomposition (see toxicology section discussion). However, the reported elevated CO saturation probably reflects antemortem CO elevation because the analysis was performed on blood and the body was relatively well-preserved.

A relatively small amount of blood (<100-200 ml) was described in the pleural cavities. The source of this blood is not apparent. No intrathoracic injuries unrelated to the fire were described.

There were multiple rectangular magnetic metallic fragments recovered from the superficial and deep soft tissues of the right lateral and anterior abdomen, left hip and anterior pelvis. The fragments appear to represent portions of a hand grenade. No visceral injuries are ascribed to these fragments. The fragments were associated with minimal or no hemorrhage. The injuries caused by the grenade appear to have been sustained after he died. Both of the other bodies found near this man had also been struck after death by grenade fragments.

Toxicologic evaluation demonstrates the presence of cyanide in the blood (1.18 mcg/ml). The source of the cyanide can be decomposition and/or inhaling the products of combustion. The ethanol in the blood (0.09 gm%) and urine (0.05 gm%) is consistent with postmortem production.

Conclusion: The gunshot wound was sustained when the firearm was discharged while the muzzle of the gun was in the oral cavity. The gunshot wound would have been immediately incapacitating and rapidly lethal since it passed through the brainstem. The entry site location, range of fire (intraoral discharge) and direction and track of the bullet are typical of those seen in self-inflicted gunshots. Although most intraoral gunshot wounds are suicidal in nature, they may be sustained in a homicidal fashion. In this scenario, the possibility of a consensual execution (suicide by proxy) or an execution involving prior restraint of the decedent should be considered. Suicide or consensual execution seems more likely given the presence of at least one other firearm death, and probably two, in the same area (assuming the injuries were received in the area in which the bodies were found) having a contact/near-contact gunshot wound entering through the forehead.

Cause of Death: Gunshot Wound of Head

Manner of Death: Undetermined (Suicide or Homicide).

MC 8-Vernon Howell (David Koresh)

Mr. Howell (Koresh), a 33 year old White man (DOB 8/17/59), was found in the communication room area along with two other men. A high power rifle was adjacent to the body. One of the other men died of a gunshot wound to the head and the other man's cause of death is undetermined but I suspect he also had a gunshot wound of the head.

The internal organs are "essentially well preserved" but there is "variable degree of postmortem decomposition."

There is a perforating gunshot wound of the head that entered through the lower forehead slightly to the right of the midline. The underlying skull defect is internally beveled and has soot deposited on the bone. Although the skin is charred, the bone is not charred. Antimony and lead were demonstrated in this area. Gunpowder was identified in the soft tissues of the forehead. The bullet passed backward through the skin, skull and brain to exit the occipital bone creating an externally beveled defect below and to the right of the occipital protuberance. The gunshot is associated with fractures of the calvarium and base of the skull. The gunshot-related injuries are associated with the presence of a large amount of blood in the airway. The range of fire is contact/near-contact. The range of fire, location of the entry site and the bullet track and path demonstrated in this Davidian are commonly seen in self-inflicted gunshot wounds of the head. However, a similar wound could be inflicted by someone else (homicide).

There is a healing gunshot wound of the pelvis that was apparently sustained on February 28, 1993. Granulation tissue and scar tissue which are indicative of healing and are consistent with a wound that was received on the previously indicated date are found within the injured soft tissues. The bullet entered the front 1/3 of the external surface of the left ilium (pelvic bone) and traveled towards the back to exit the posterolateral lower back. The bone has an internally beveled 43 mm displaced chip of bone.

There is evidence of smoke inhalation. Soot is present in the airway. The midtrachea is partially destroyed by fire. However, there is dense soot described in the small airways. Microscopic examination of lung tissue reportedly also demonstrates the presence of soot. The blood CO saturation is reported as 24%.

Global charring is present. There is extensive destruction of the extremities. The abdomen and posterior right chest wall are destroyed and the chest/abdomen contents are focally charred. The burning of the skull occurred after the gunshot wound was sustained.

There is a small shrapnel fragment that has penetrated the greater trochanter of the left femur. No hemorrhage is associated with this wound. This wound was caused by a fragment of a hand grenade striking the body after death. The other two men found in this area also had postmortem grenade shrapnel injuries.

Toxicologic examination demonstrates the presence of ethanol in the blood (0.1 gm%) and bile (0.14 gm%) which is consistent with postmortem production.

DNA studies performed on the bodies recovered from the complex indicate to a reasonable degree of probability that David Koresh fathered at least 12 of the children who died. These include the Summers fetus (MC 31B/58), Dayland Little (MC 33), Little fetus (MC 47C), Pages Gent (MC 64), Chanel Andrade (MC 62), Star Howell (MC 67-1), Cyrus Howell (MC 67-2), Bobbie Koresh (MC 67-5/69), Hollywood Sylvia (MC 67-4), Mayannah Schneider (MC 70/51A) and the Jones twins (MC 63 and MC 73). Each of these children, including the two that were unborn, were found in the concrete bunker.

Conclusion: The lethal injury is the gunshot wound of the head. The extent of the damage indicates the gunshot wound of the head was caused by a low velocity projectile and excludes a high velocity gunshot wound. This man was also breathing when he was exposed to the smoke from the fire. At the time he sustained the lethal gunshot wound to the head he already had a gunshot wound involving the pelvis that had been present since February 28, 1993.

Cause of Death: Gunshot Wound of Head.

Manner of Death: Undetermined (Suicide or Homicide).

Kitchen / Serving Area

There were twelve adults found in the kitchen/serving area. Two of the twelve persons found in this area were sisters. Both died from the effects of the fire. Eight of these persons succumbed from the fire and three died of gunshot wounds. At least one of the firearm injuries is consistent with being self-inflicted. The cause of death of one person in this area cannot be determined. One person was struck after death by a hand grenade fragment.

MC 9-Clifford Sellors

Mr. Sellors, a 33 year old White man (DOB 3/28/60), was recovered from the kitchen/serving area. There were 11 other persons found in this area. Some of the decedents in this area died of the effects of the fire while others had sustained lethal gunshot wounds.

There is evidence consistent with smoke inhalation. The CO saturation is reported as 66% in the clotted blood submitted for analysis. The airways could not be assessed for the presence of soot since the trachea and other portions of the pulmonary system are incinerated.

Global charring is present with incineration of the extremities and the head except for extremely rudimentary fragments of the skull base. Charred fragments of the posterior portion of the brain, midbrain and medulla were present. Few visceral organs were present. These tissues demonstrated the effects of heat but advanced decomposition was not described. No injuries to the heart or liver were identified. No firearm injuries were identified. However, gunshot wounds involving the head or portions of the chest/abdomen cannot be excluded.

Toxicologic evaluation demonstrates the presence of cyanide in the blood (0.25 mcg/ml) and urine (0.35 mcg/ml) which is consistent with decomposition or the inhalation of smoke. The ethanol that was demonstrated in the blood (0.01 gm%) and urine (0.02 gm%) is consistent with postmortem production.

Conclusion: The CO detected in the clotted blood submitted for toxicologic evaluation probably reflects antemortem elevation of the blood CO saturation. Decomposition of this specimen does not seem to be advanced enough to account for a completely false positive laboratory result. No lethal injuries unrelated to the fire are identified. I do not see any compelling reason to believe that there was a gunshot wound of the head or portions of the chest/abdomen although gunshot wounds to these areas cannot be categorically excluded. The three persons in this area who definitely had gunshot wounds were clustered together. Mr. Sellors was near this group of three persons but did not constitute a portion of the cluster. On balance, I believe Mr. Sellors' death was most likely caused by the fire.

Cause of Death: Smoke inhalation, thermal burns.

MC 10-Sonia Murray

Ms. Murray, a 30 year old Black woman (DOB 8/18/62), was recovered from the kitchen/serving area along with 11 other persons. Some of the decedents in this area died due to the effects of the fire and others had sustained lethal gunshot wounds. She was found immediately adjacent to MC 9 and did not form a portion of the cluster of bodies with definite gunshot wounds.

There is moderate decomposition. Global charring is present. Portions of the extremities are absent. Postmortem fractures of the skull are present. The brain is cooked.

There is evidence of smoke inhalation. The tracheobronchial system contains mild-moderate soot. The CO saturation in a sample of clotted blood is reported as 79%.

There appears to be a pre-fire fracture of the margin of the right temporal bone. The right middle cranial fossa was noted to contain a "significant quantity of clotted blood."

No gunshot wounds are identified. However, a gunshot wound involving the head cannot be excluded due to the fire-related damage.

Toxicologic evaluation indicates the presence of cyanide in the blood (0.26 mcg/ml) which could have arisen due to decomposition or the inhalation of smoke. The ethanol in the blood (0.01 gm%) is consistent with postmortem production.

Conclusion: The presence of soot in the lower portions of the airway indicates she was breathing when she was exposed to the smoke from the fire. Elevation of the CO saturation measured in a sample of clotted blood is probably related to smoke inhalation. I think it is unlikely that the effects of decomposition within a specimen of clotted blood would account for the observed CO. In addition to injuries caused by the fire, she also appears to have a fracture of the right temporal bone that was not directly caused by the fire. There was clotted blood in the floor of the skull adjacent to the fractured area which indicates she was alive when she received the head injury. The nature of her head injury is not ascertainable. Fire-related damage prevents excluding the presence of a gunshot wound involving the head; however, the extent of the damage reasonably excludes a high velocity gunshot. I cannot determine whether or not she was conscious for some period of time while she was breathing the smoke or whether she was conscious when she sustained the head injury.

Cause of Death: Smoke Inhalation, thermal burns. Antemortem head trauma may have contributed to death.

MC 11–Sherry Jewell

Ms. Jewell, a 43 year old White female (DOB 3/10/50), was found along with 11 other persons in the kitchen/serving area. Some of these persons died of gunshot wounds and others died due to the effects of the fire. Ms. Jewell was found across from the 3 persons who had demonstrable gunshot wounds but there was some separation between her and the cluster of these three bodies.

There is moderate decomposition.

There is evidence of smoke inhalation. Soot is present in the airway. The blood CO saturation is reported as 15%.

Global charring is present. The head, extremities and portions of the torso are missing.

No evidence of a gunshot injury is seen. No clotted blood was identified in the airway. A gunshot wound of the head cannot be excluded due to the fire damage.

Decomposition and/or smoke inhalation can account for the cyanide found in the blood (3.5 mcg/ml) and urine (3.3 mcg/ml). The ethanol found in the urine (0.01 gm%) is consistent with postmortem production.

Conclusion: Soot in the lower portion of the airway is indicative of smoke inhalation. No lethal injuries unrelated to the fire are demonstrated. However, the extensive fire damage prevents excluding a gunshot wound of the head. I do not see any compelling evidence to suggest the presence of a gunshot wound. The lack of clotted blood within the airway does offer some support for excluding a large caliber gunshot wound of the head. On balance, I believe her death was most likely caused by the fire.

Cause of Death: Smoke inhalation, thermal burns.

MC 14-Margarida Vaega

Ms. Vaega, a 47 year old Asian woman (DOB 3/17/46), was found in the kitchen/serving area along with 11 other persons. Some of these persons died due to the fire and others died of demonstrable gunshot wounds. Ms. Vaega's body was not a part of the cluster of the three bodies exhibiting gunshot wounds.

Decomposition is relatively mild.

Evidence of smoke inhalation includes minimal soot within a small fragment of the right lung lower lobe and a reported blood CO saturation of 33%.

There is global charring. The body is fragmented and there is loss of viscera. The skull is absent.

There is no evidence of a gunshot wound. However, the fire damage does not allow definitive exclusion of gunshot wounds of the head and chest/abdomen.

The presence of cyanide in the blood (0.51 mcg/ml) can be due to decomposition or smoke inhalation. Postmortem production can account for the ethanol found in the blood (0.02 gm%).

Conclusion: Soot in the lower portions of the airway indicates smoke inhalation. Elevated CO saturation in the clotted blood submitted for analysis is also likely related to smoke inhalation. The extent of decomposition does not appear to be sufficient to account for a completely false positive CO analysis. I do not see any compelling evidence of a gunshot wound. Her remains were not found immediately adjacent to a decedent having a demonstrable gunshot wound. However, the extent of the thermal damage prevents definitely excluding the presence of a gunshot wound. On balance, I believe her death was most likely the result of the fire.

Cause of Death: Smoke inhalation, thermal burns.

MC 15-Adebowalo Davies

Mr. Davis, a 30 year old Black man (DOB 10/30/62), was found in the kitchen/serving area along with 11 other persons. Some of these persons died of gunshot wounds and others succumbed to the effects of the fire. Mr. Davis was not found within the cluster of persons with definite gunshot wounds of the head.

There is extensive fire damage to the respiratory system. "Only a small quantity of soot" is described in the lung tissue. No carbon monoxide is found in the sample of clotted blood submitted for analysis.

There is extensive charring of the body. The recovered remains consist primarily of a charred torso/pelvis and some remnants of skull base.

There is no evidence of a gunshot wound. However, a gunshot injury of the head cannot be excluded due to the fire damage.

Cyanide found in the blood (0.37 mcg/ml) and urine (0.51 mcg/ml) is consistent with decomposition and/or smoke inhalation.

Conclusion: Although it may be related to breathing smoke, I am not sure that the small quantity of soot described within the lung tissue is proof of smoke inhalation in light of the extensive thermal damage involving the respiratory structures and the lack of demonstrable CO in the blood. In addition, the extent of the fire damage prevents excluding gunshot or other injury involving the head. I believe the cause of death is best left undetermined since a lethal injury cannot be definitively demonstrated.

Cause of Death: Undetermined.

Manner of Death: Undetermined (Homicide or Suicide).

MC 16--Vanessa Henry

Ms. Henry, a 19 year old Black woman (DOB unknown), was found in the kitchen/serving area along with 11 other decedents. Some of these persons died of gunshot wounds and others died of the effects of the fire. Ms. Henry was not found within the cluster of persons having demonstrable firearm injuries. Her body is found reasonably close to the body of Diana Henry (MC 18) and in the area of the side of the room near the stairway where Stephen Henry (MC 21) and Phillip Henry (MC 22) were found. Her mother, Zilla Henry (MC 28), was found in the hallway.

Decomposition is relatively mild. There is global charring. The skull is fragmented. The forehead and much of the face is absent. The reconstructed bone fragments from the skull show no evidence of a firearm injury. The extremities are missing. The chest/abdominal wall is missing except for the upper left chest.

The airway is intact except in the region of the midtrachea. A small amount of soot is present within the airway. The blood CO saturation is reported as 29%.

There is no evidence of any gunshot wound.

Conclusion: Soot deposition in the lower airway is evidence of smoke inhalation. The elevated CO saturation demonstrated in the blood also supports smoke inhalation. The extent of decomposition does not seem sufficient to account for a false positive blood CO analytic result. No lethal injuries unrelated to the fire are demonstrable.

Cause of Death: Smoke inhalation, thermal burns.

MC 17--Sandra Hardial

Ms. Hardial, a 27 year old Black woman (DOB 2/9/66), was found in the kitchen/serving area along with 11 other persons. Some of these persons died of gunshot wounds and others succumbed to the effects of the fire. Ms. Hardial was not found within the cluster of bodies having demonstrable firearm injuries.

There is mild decomposition

There is evidence of smoke inhalation. Soot is present in the tracheobronchial tree. The blood CO saturation is reported as 38%.

There is global charring. The remains consist primarily of a torso with much loss of tissue including the chest wall. The lungs are charred. There is loss of substantial portions of the skull. The left middle fossa and the petrous ridge of the skull are present.

No gunshot wounds are identified. Gunshot wounds of the head and chest/abdomen cannot be excluded because of the fire damage.

The cyanide found in the blood (0.51 mcg/ml) and bile (0.09 mcg/ml) is consistent with decomposition and/or smoke inhalation. Postmortem production can account for the ethanol found in the bile (0.01 gm%).

Conclusion: The smoke within the lower airway indicates smoke inhalation. The elevated blood CO saturation is also likely due to smoke inhalation in that the extent of decomposition does not seem sufficient to account for a false positive CO analysis. No lethal injuries unrelated to the fire are demonstrable. There is no compelling evidence suggesting the presence of a firearm injury; however, the extent of fire damage prevents definitively excluding a gunshot involving the head or chest/abdomen.

Cause of Death: Smoke inhalation, thermal burns.

MC 18--Diana Henry

Ms. Henry, a 28 year old Black woman (DOB unknown), was found in the kitchen/serving area along with 11 other decedents. Some of these persons died of gunshot wounds and others succumbed to the effects of the fire. Ms. Henry was not found within the cluster of persons having demonstrable gunshot wounds. A gun was adjacent to her body. She was found in the same general area as Vanessa Henry (MC 16). Her body was recovered near the wall of the room closest to the stairway in which Stephen (MC 21) and Phillip Henry (MC 22) were found. Her mother, Zilla Henry (MC 28), was found in the adjacent hallway.

The proximal trachea is absent. The distal trachea/mainstem bronchi has a small amount of soot. The right lung is congested and a small amount of soot is present in the bronchi. The blood CO saturation is reported as 26.5%.

There is global charring. The right anterior chest/abdomen and portions of the pelvis are missing. Extensive tissue loss is seen involving the extremities. The calvarium, brain (except for a portion of the medulla) and portions of the facial bones and base of the skull are absent. A portion of the right mandible and a portion of the base of the skull remain.

No gunshot wounds are identified. A gunshot wound of the head cannot be excluded because of the fire damage.

A fragment of magnetic metal consistent with a part of a hand grenade was recovered along with other materials from "under the body and from the residual skull." There is no evidence of an antemortem injury caused by a grenade.

The cyanide found in the blood (0.12 mcg/ml) could be due to decomposition or smoke inhalation. Postmortem production can account for the ethanol found in the blood (0.02 gm%).

Conclusion: The soot in the lower portion of the airway represents smoke inhalation as does the elevated CO saturation demonstrated in the blood. I think it is unlikely decomposition was advanced enough to account for a false positive CO analysis. No lethal injuries unrelated to the fire are demonstrated. However, fire damage prevents definitive exclusion of a gunshot wound to the head. There is no compelling evidence to suggest that a gunshot wound is present.

Cause of Death: Smoke inhalation, thermal burns.

MC 19-Beryl Teresa Nobrega

Ms. Nobrega, a 48 year old Black woman (DOB 2/15/45), was found in the kitchen/serving area with 11 other persons. Some of these persons died of gunshot wounds and others succumbed to the fire. She was not found within the cluster of persons having demonstrable gunshot wounds to the head.

There is evidence supporting the presence of smoke inhalation. The proximal trachea is absent. The 9½ inches of mid-distal trachea contains soot. Some of the muscle tissue is described as being red. The CO saturation is reported as 29% (liver) and 35% (spleen).

There is global charring. The base of the skull and the calvarium to the level of the squamosal sutures is present. The brain is charred but appears reasonably intact and no antemortem injury is discerned.

No evidence of gunshot injury is identified.

Toxicologic evaluation demonstrates the presence of cyanide in the urine (0.15 mcg/ml). The cyanide could be related to decomposition and/or smoke inhalation.

Conclusion: The presence of soot in the long segment of residual trachea probably reflects some smoke inhalation, although passive deposition cannot be entirely excluded. Smoke inhalation is further supported by the laboratory detection of CO in liver and spleen tissue (see toxicology discussion regarding CO interpretation). The tissues appear reasonably well preserved. The anthropology description of the muscle tissue as being "red" would be consistent with binding of CO to the muscle forming carboxymyoglobin. On balance, I believe the evidence indicates smoke inhalation. This interpretation is further supported by the lack of any demonstrable lethal injury unrelated to the fire.

Cause of Death: Smoke inhalation, thermal burns.

MC 43--Lisa Farris

Ms. Farris, a 24 year old White woman (DOB 9/18/68), was found in the kitchen/serving area along with 11 other decedents. Some of these persons died of gunshot wounds and others succumbed to the fire. Ms. Farris was found immediately alongside of 2 other persons having lethal gunshot wounds.

There is a gunshot wound perforating the head. There is a 23 x 12 mm entry site of the squamosal portion of the left temporal bone immediately posterosuperior to the temporomandibular joint. The bullet exited through the right frontal bone (20 mm externally beveled defect) slightly anterior to the coronal suture. The range of fire cannot be determined due to the effects of burning and fragmentation.

There is extensive fire damage involving the respiratory tract. The proximal airways are incinerated and the lungs are burned. There is evidence consistent with smoke inhalation. The posterior lung small airways "appear blackened due to soot deposition." The blood CO saturation is reported as 41%.

There is global charring. The torso is extensively charred with extensive loss of the tissues of the extremities.

Decomposition and/or smoke inhalation could account for the cyanide detected in the blood (0.25 mcg/ml). The ethanol measured in the blood (0.02 gm%) is consistent with postmortem production.

Conclusion: There is a gunshot wound of the head having the characteristics of a low velocity projectile. The features of the wound exclude a high velocity gunshot. The entry site (temporal area) is a common entry site for a self-inflicted injury. Self-inflicted gunshots entering the left temple are less common than those entering the right temple but nevertheless they do occur. The fire damage in the area of the entry site prevents determining the muzzle-scalp distance. Thus, no opinion can be rendered as to whether or not this injury could have been self-inflicted. On balance, I believe there is sufficient evidence to indicate smoke inhalation. It cannot be ascertained whether or not she was conscious when she began breathing smoke.

Cause of Death: Gunshot Wound of the Head. Smoke inhalation may have hastened death.

Manner of Death: Undetermined (Suicide or Homicide).

MC 44--Jeffrey Little

Mr. Little, a 31 year old White man (DOB 7/13/61), was found along with 11 other decedents in the kitchen/serving area. Mr. Little was found in a cluster with two other persons who had gunshot wounds. Other decedents in the kitchen/serving area succumbed to the fire.

There is a wound of the left chest. A 70 x 66 mm perforation is present between the left 5-7 ribs. The adjacent ribs are fragmented. A large amount of blood is present in the left chest, across the mediastinum and to the right chest. The esophagus, stomach, pericardium and heart are not injured. No gunshot defects are noted in the lungs. Blood is present within the airways. Fire has destroyed most of the right chest wall. The range of fire cannot be determined.

There is a 4 x 4 x 2 mm defect in the left anterior iliac crest. A 9 x 3 x 2 mm defect of the lateral left ilium is present. These do not appear to be antemortem firearm injuries. The exact cause of these defects is not apparent.

There is global charring with tissue loss. The right portion of the skull is absent. The left aspect of the skull appears intact. The intrapulmonary airways contain soot. The blood CO saturation is 17.5%.

The cyanide in the blood (0.25 mcg/ml) and bile (0.04 mcg/ml) is consistent with decomposition or the inhalation of smoke. Decomposition can also account for the ethanol detected in the blood (0.12 gm%) and bile (0.01 gm%).

Conclusion: Although a discrete wound track cannot be identified, overall, the findings support a lethal projectile wound of the chest. The wound is consistent with a low velocity gunshot or some other projectile such as a fragment from one of the hand grenades. The lack of any other evidence of a grenade injury involving Mr. Little and the presence of other Branch Davidian decedents with gunshot wounds in proximity to this person makes it most likely that the observed injury is a low velocity gunshot with the corresponding entry/exit site obliterated by postmortem burning. No evidence of contusion or laceration of the adjacent thoracic organs is reported. I would expect more extensive damage if a high velocity firearm projectile was responsible for the injuries. I also think it is unlikely that the chest defect is entirely an artifact of burning. The perforation through the chest wall, fragmentation of adjacent ribs and the distribution of the hemorrhage within the chest reasonably excludes blunt force as the causative mechanism of injury. No assessments of range of fire or whether the injury could have been self-inflicted are possible due to fire damage.

In addition to the gunshot wound, there is evidence of smoke inhalation. I cannot ascertain if Mr. Little was conscious when he began to inhale smoke from the fire.

Cause of Death: Gunshot Wound of Chest.

Manner of Death: Undetermined (Homicide or Suicide).

MC 45--Mary Borst

Ms. Borst, a 39 year old White woman (DOB 9/13/43), was found in the kitchen/serving area along with 11 other persons. She was found clustered with two other bodies having gunshot wounds. Some of the other persons in the kitchen/serving area succumbed to the fire.

There is a gunshot wound of the chest/abdomen. The wound track is via the apex of the left lung lower lobe, left lung upper lobe perihilar lung, basilar cardiac left ventricle, diaphragm, esophagogastric junction/proximal stomach, inferior left lobe of the liver. The gunshot damage is associated with a significant amount of hemorrhage. The entry and exit sites are not seen due to the effects of fire. The direction of fire is not able to be definitively established. The autopsy report suggests the direction is forward based on the size of the wound track at the lung/heart. However, this opinion does not appear to take into account the different physical characteristics of these tissues.

A defect is described in the left occipital bone lateral to the midline and superior to the external occipital protuberance. The defect is circular and externally beveled. If this is a gunshot exit site, the likely entry site would be in the right frontal bone which is too fragmented to allow identification of an entry defect. No wound track is identified within the brain; however, the brain has been damaged by the fire.

There is a fracture of the anterior left third rib associated with minimal hemorrhage in the adjacent soft tissue. A plastic disc is present in the soft tissue. Other high velocity munitions are present. The left third rib defect and the plastic appear to be related to postmortem penetration by a cooked off cartridge.

There is a non-displaced minimal fracture at the fifth cervical vertebra. Minimal blood is associated with this injury. This is probably also postmortem.

No soot is described within the intact airway. The blood CO saturation is reported as 37.5%.

Global charring is present. The extremities and portions of the pelvis are absent. There is extensive skin and soft tissue loss.

There is an old fracture of the mandible which had been surgically wired.

The ethanol found in the bile (0.03 gm%) is consistent with postmortem production. No ethanol was found in the blood.

Conclusion: She was alive when she received the gunshot wound of the chest/abdomen as evidenced by the extensive hemorrhage from the organs/tissues damaged by the gunshot. The extent of the organ damage is characteristic of a low velocity projectile. I would expect more tissue disruption if the wounding was done by a high velocity projectile. Fire damage prevents identifying the entry/exit sites, range of fire and whether or not the injury could have been self-inflicted.

I believe she most likely also had a gunshot wound that entered the front of her head and exited through the defect identified in the back of the head. Fire damage prevents identifying the entry site, the range of fire and whether or not the wound could have been self-inflicted. The wound has the features of a low velocity gunshot and does not have the expected features of a high velocity projectile.

Although persons having more than one gunshot are most often shot by someone else, multiple self-inflicted gunshots occasionally occur. If her chest/abdomen wound was sustained first, there is nothing about the vital organ damage that would preclude these wounds from being self-inflicted. Based on the expected path of the bullet through the head, I would expect the gunshot wound of the head to be immediately incapacitating. As noted above, no assessment of the possibility of either wound being self-inflicted is possible since the entry sites are not available for examination.

It is not entirely clear if there was antemortem inhalation of smoke or if the postmortem CO measurement is a false positive result due to decomposition. However, the amount of decomposition does not seem to be to the extent to account for a false positive blood CO analysis. In addition, the other persons in this area having gunshot wounds demonstrate evidence of smoke inhalation. On balance, I think the elevated CO saturation is due to smoke inhalation.

Cause of Death: Gunshot wounds of Head and Chest/abdomen.

Manner of Death: Undetermined (Homicide or Suicide).

MC 46--Human bone

No further information is available about this isolated specimen.

Kitchen--Stairway

The remains of three men were recovered from the area of the kitchen stairway. Two of these men are brothers. All three of these men died of gunshot wounds. The wounds of two of the men are consistent with being self-inflicted. The other man's wounds were likely received at the hands of another Davidian. No evidence of smoke inhalation is seen in two of the men. Two of these men were struck after death by hand grenade fragments.

MC 20--James Riddle

Mr. Riddle, a 32 year old White man (DOB 4/25/60), was found in the area of the kitchen stairway. He was found along with two other men. Lethal gunshots are present in all these men.

There is advanced decomposition.

There is a gunshot wound of the head of contact/near-contact range. The entrance is in the anterior left forehead. Soot is present on the margin of the internally beveled 3/8 inch defect. Barium, antimony and lead are identified on the wound margin. The wound track is backward and downward. The bullet passed through the left cerebrum and cerebellum to exit the left occipital area 1 inch below and 2 inches to the left of the nuchal crest. Residual hemorrhage is present in the region of the wound track through the head even though the exact wound track is obscured by the effects of decomposition, insect infestation and fire. Skull fractures associated with the gunshot are present. The wound is consistent with being self-inflicted; however, a gunshot at the hands of another person cannot be excluded.

No evidence of smoke inhalation is noted. There is no soot identified in the airway and no CO is found in the blood.

There are shrapnel injuries consistent with a postmortem grenade explosion. The anterior right second rib has an internally beveled defect with a metallic fragment in the adjacent soft tissue. Other fragments were reportedly recovered from the right chest wall, left posterior chest wall, superficial aspect of the right liver and the clothing at the left elbow.

Postmortem production accounts for the ethanol found in the urine (0.02 gm%) and bile (0.03 gm%).

Subsequent to the original examination of this person's remains, the remains were examined by a forensic pathologist who was retained by the decedent's family or their representative. This expert indicated the presence of displacement of the 2-5 lumbar vertebral spinous processes, portions of the sacrum at the innominate articulation, right femur greater trochanteric tuberosity, left innominate ala, distal left humerus, some left ribs, some right ribs and the lateral portion of the right clavicle. Some of the avulsed areas show burn marks and others do not. The portions of the skull involved by the gunshot defects were not available for re-evaluation. This expert opined that the skeletal findings are "consistent with a military tank having torn the body apart" and that the avulsion of bones can be caused by "a military tank driving over a body or a portion of the body."

I do not agree with this expert's opinion that the observed injuries are consistent with having been caused by a military tank. Photographs of the body at the scene and the subsequent examination at the morgue do not indicate the presence of the extensive crush injuries that I would expect if this person had been struck or run over by a military tank or other tracked vehicle. In my opinion, the findings are not consistent with having been struck or run over by a military tank or other tracked vehicle.

Conclusion: There is a lethal contact/near-contact gunshot wound of the head that is consistent with being self-inflicted. However, a gunshot at the hands of another person cannot be excluded. No other definite antemortem injuries are demonstrated. There is no evidence of smoke inhalation. Shrapnel from an exploding hand grenade struck the body after death.

Cause of Death: Gunshot wound of the head.

Manner of Death: Undetermined (Suicide or Homicide).

MC 21--Stephen Henry

Stephen Henry, a 26 year old Black man (DOB 10/26/66), was found along with two other men in the area of the kitchen stairway. One of the other men was his brother Phillip Henry (MC 22). A firearm magazine accompanies the body. A wrist watch was found near the left shoulder. The watch stopped at 12:28. Lethal gunshot wounds were found in all the men in this area. Vanessa (MC 16) and Diana Henry (MC 18) were found in the kitchen/serving area. Zilla Henry (MC 28) was found in the area of the hallway.

Decomposition is advanced.

There is a contact/near-contact gunshot wound of the head. The entry is in the right anterior forehead. Soot is present on the wound edges. Barium, antimony and lead are identified on the bone at the entry site. The wound track is backward. The bullet passed through the right cerebrum to exit the right occiput creating an externally beveled defect. The wound track through the brain is not apparent due to postmortem liquefaction of the brain tissue. Hemorrhage is present in the subdural space. Skull fractures related to the gunshot are present. The gunshot is consistent with being self-inflicted; however, a gunshot at the hands of another person cannot be excluded.

There is a separate fracture perpendicular to the midline across both parietal bones (103 mm) located 23 mm from the bregma.

There is extensive burning.

No soot is identified in the airways. The blood CO saturation is reported as 24%. It is not clear if the CO is a true reflection of the antemortem CO or if it is a false positive related to the advanced decomposition (see toxicology section discussion regarding the interpretation of CO).

Grenade fragments were recovered from the soft tissues of the legs during the TCMEO autopsy. These fragments are noted in the evidence collection section of the autopsy report. No wound tracks or hemorrhage are described in relation to these fragments.

Toxicologic evaluation demonstrates the presence of ethanol in the blood (0.02 gm%), chest fluid (0.06 gm%) and vitreous (0.01 gm%). The ethanol is consistent with postmortem production.

Mr. Henry's remains were re-examined upon his repatriation to the UK. The UK evaluation identified the right frontal entry defect and the occipital exit site. Determination of the cause of death was deemed to be precluded except to say that it was consistent with a gunshot wound of the forehead. No range determination was possible. A firearms expert indicated the presence of unfired 5.56 mm ammunition, primer units and cast iron grenade fragments in the region of the left thigh. He indicates that the body was lying on or near live cartridges and further indicated that "bearing this in mind, the injury to the head could have been caused by a high velocity rifle bullet fired so as to enter the front of the head and exit from the back of the head" seemingly suggesting that a cooked off unchambered bullet may have perforated the head. He also indicates the possibility that the head wound is the result of the base plug or some "other substantial fragment" of the same grenade that caused the "other" (thigh) injuries.

The TCMEO observations clarify and refute some of the UK observations/speculations. The range of fire of the bullet that passed through the head is contact/near-contact as evidenced by the soot and primer residue deposited on the bone at the entry site. It would be unlikely that a cooked off unchambered round would create a round entry hole in the bone as seen on the photographs of the skull, leave primer residue in substantial amounts around the entry defect and have sufficient velocity to perforate the head, especially through two relatively thick bones.

Similarly, these features of the entry site are not consistent with a hand grenade fragment. A hand grenade exploded at contact/near-contact range would be associated with more damage to the skull than is present and would not be associated with deposition of gunshot primer components. Additionally, the distribution of the hand grenade fragments in the thigh without any fragments in the chest or abdomen would also make it unlikely that a fragment from the grenade responsible for the thigh fragments would also be responsible for a single fragment perforating the head (notwithstanding the other features of the head wound that exclude any reasonable possibility that is related to a grenade).

Conclusion: There is a lethal gunshot wound of the head that is consistent with being self-inflicted. However, a gunshot would at the hands of another person cannot be excluded. The features of the wound are those of a low velocity firearm and not of a high velocity projectile. The body was struck by shrapnel from a hand grenade after death.

Cause of Death: Gunshot wound of head.

Manner of Death: Undetermined (Suicide or Homicide).

MC 22--Phillip Henry

Phillip Henry, a 22 year old Black man (DOB 4/26/70), was found in the area of the kitchen stairway. The rubber face portion of a gas mask was present. He was found along with two other men who also died of gunshot wounds. One of these men was his brother Stephen Henry (MC 21). Vanessa (MC 16) and Diana Henry (MC 18) were found in the kitchen/serving area. Zilla Henry (MC 28) was found in the area of the hallway.

There is a penetrating gunshot wound of the upper chest. Although the entry site is not specifically seen, the wound track indicates an entry site in the upper right chest. The wound track is backward, rightward and downward. The wound track is via the anterior right upper ribs, right lung upper lobe apex, right lung upper lobe, posterior right 2-4 ribs (primarily the fourth rib) to come to rest in the right shoulder soft tissue. A brass jacketed bullet (6R) in the .38 caliber family of Chinese Norinco origin was recovered. There is a right hemothorax (500 ml) and a large amount of blood in the tracheobronchial tree. The entry site and wound track are not typical of a self-inflicted wound. This wound appears to have been received at the hands of another person.

There is a perforating gunshot wound of the head. The entry and exit sites are not able to be identified because of the effects of burning. No estimation of the range of fire can be made. The wound track is not evident due to loss of bone and brain tissue. The calvarium is absent above the midtemporal level. There is fracturing of the left temporal bone with complete separation beginning anterior to the mastoid process and dissociating the petrous portion of the temporal bone. The occipital bone fracturing extends to the foramen magnum. This area is not burned. Blood is present in the sphenoid sinuses. The lungs are congested and edematous. In view of the other gunshot, this wound is also probably at the hands of another person.

No evidence of smoke inhalation is seen. No soot is identified in the lungs. No CO is found in the blood.

There is extensive burning.

Decomposition can account for the ethanol found in the blood (0.01 gm%), bile (0.02 gm%) and urine (0.03 gm%). The cyanide in the blood (0.16 mcg/ml) and urine (0.04 mcg/ml) is consistent with decomposition.

The repatriated remains were re-examined in the UK. The UK examination report indicates they were unable to confirm the presence of a gunshot wound of the head since any structures involved by this gunshot were not available for examination. The report also indicates that they did not find any evidence of a right upper torso gunshot wound. It is noted that the rib cage appears complete and no gunshot-related bony injury is observed. The UK firearms expert indicates no gunshot injury was identified involving bone from "what was left of the chest." The presence of advanced decomposition is noted. It is also noted that the received tissues showed no

evidence of having been subjected to significant heat.

The inability of the UK examiners to confirm the presence of a gunshot wound of the head is obviously related to the lack of adequate tissue from this area for evaluation. The wound track through the visceral organs identified during the initial autopsy was not apparent during the UK exam due to the advanced decomposition of the viscera. However, other observations made in the UK are at odds with the observations made during the initial autopsy. The initial examination indicates the presence of fractures of the right 1-4 ribs. The anthropologist's report indicates these ribs were removed for further examination. There are photographs of radiographs of these ribs after they have been removed. The photographs clearly depict damage to these ribs. In addition, a bullet that had been fired through a gun barrel was recovered from the body. The reports of the initial examination indicate and the photographs confirm that there are extensive fire-related alterations of the body.

Conclusion: There are gunshot wounds of the head and the torso. It cannot be definitively established whether or not the wounds could have been self-inflicted. The range of fire of the wounds cannot be determined. The gunshot entering the upper right chest is not a typical entry site for a self-inflicted gunshot of the chest and was most likely inflicted by another person. The entry site of the gunshot wound of the head cannot be demonstrated. The presence of a gunshot wound of the chest not typical of a self-inflicted wound increases the probability that the head wound was also not self-inflicted. However, self-infliction of either or both wounds cannot be definitively excluded on the basis of the currently available information. On balance, I believe he most likely sustained these injuries at the hands of another person. The wound involving the torso was caused by a low velocity projectile. The nature of the projectile injuring the head cannot be determined; however, there is nothing about the damage to the head that particularly suggests damage by a high velocity projectile. No other significant antemortem injuries are identified. There is no evidence of smoke inhalation.

Cause of Death: Gunshot Wounds of the Head and Chest.

First Floor Hallways

Six adult women and one teenage female were found in the area of the hallway. Two of the adult women are in-laws. Family members of one of the women were found in the areas of the kitchen. Each of the persons found in the area of the hallway succumbed from the effects of the fire.

MC 23--Susan Benta

Ms. Benta, a 31 year old Black woman (DOB 9/15/61), was found in the area of the first floor hallway. A gun was adjacent to the body. She was found with 6 other women.

The blood CO saturation is reported as 59%. The pulmonary tissues are absent due to fire.

There is global charring with extensive destruction and loss of chest/abdominal tissues.

No evidence of a gunshot wound is present. Although portions of the skull are absent, there is enough of the skull present to reasonably exclude a gunshot of the head. A gunshot of the chest/abdomen cannot be excluded due to the fire damage.

The cyanide detected in the blood (1.9 mcg/ml) can be accounted for by decomposition and/or smoke inhalation.

The repatriated remains were re-examined in the UK. The UK examination indicates the inability to evaluate the cause of death due to the amount and condition of the tissue available for evaluation.

Conclusion: The elevated blood CO saturation supports the presence of smoke inhalation. Fire damage prevents evaluation of the lower portions of the airway for soot deposition. No lethal injuries unrelated to the fire are demonstrated, although fire damage prevents excluding a gunshot involving the chest/abdomen. There is no compelling evidence suggesting that a gunshot of the chest/abdomen is present. No lethal injuries unrelated to the fire were definitively established in the other individuals found in this area. On balance, I believe the currently available information indicates she succumbed to the effects of the fire.

Cause of Death: Smoke inhalation, thermal burns.

MC 24--Allison Monbelly

Ms. Monbelly, a 31 year old Black woman (DOB 8/8/61), was found in the area of the first floor hallway. She was found along with 6 other women.

There is global charring with extensive loss of tissue and destruction and distortion of viscera. The head/neck is destroyed.

The pulmonary system is absent. The blood CO saturation is reported as 15%.

The cyanide detected in the blood (0.65 mcg/ml) is consistent with decomposition and/or smoke inhalation.

Gunshot wounds to the head/neck and chest/abdomen cannot be excluded because of the thermal damage.

Conclusion: The reported blood CO saturation supports the presence of smoke inhalation. Fire damage prevents evaluating the lower portions of the airway for soot deposition. No lethal injuries unrelated to the fire are demonstrated. Although gunshot wounds of the head and chest/abdomen cannot be excluded because of fire damage, there is no compelling information suggesting the presence of a gunshot. No lethal injuries unrelated to the fire were definitively established in any of the persons found in this area. On balance, I believe the current information indicates she succumbed to the effects of the fire.

Cause of Death: Smoke inhalation, thermal burns.

MC 25--Yvette Fagan

Ms. Fagan, a 30 year old Black woman (DOB 8/30/60), was found in the area of the first floor hallway. She was found along with 6 other women including her mother-in-law.

The small airways of the right lung contain soot. Most of the trachea and portions of the left lung are absent. The blood CO saturation is recorded as 68%.

Global charring has resulted in extensive tissue loss. Heat fractures are present.

There is a 17×14 mm ovoid defect of the right mandible. No fractures are present in this area or internally. This appears to be a postmortem defect.

No evidence of a gunshot is found. Thermal damage precludes definitively excluding a left chest gunshot. There is nothing to suggest the presence of a gunshot involving the left chest.

The cyanide found in the blood (0.14 mcg/ml) is attributable to decomposition and/or smoke inhalation. The bile ethanol (0.01 gm%) is consistent with decomposition.

Conclusion: There is evidence of smoke inhalation. No evidence or suggestion of a lethal injury unrelated to the fire is present.

Cause of Death: Smoke inhalation, thermal burns.

MC 26--Martin child

A teenage Martin woman (15-19 years old) was found in the area of the first floor hallway. She was found along with 6 other women. She was identified as one of the Martin children by DNA analysis. Her father, Douglas Martin(MC 5), was found in the rear of the chapel and her sister was found in the concrete bunker (MC 50/61).

Only the distal trachea is present. Soot, debris and blood are present. The lungs are charred. The blood CO saturation is reported as 38%.

There is global charring with extensive tissue loss. Most of the head is absent. A segment of the basilar skull is present.

No gunshot injuries are observed. A gunshot wound of the head cannot be excluded.

The cyanide found in the blood (0.7 mcg/ml) and bile (0.05 mcg/ml) are consistent with decomposition and/or smoke inhalation. The ethanol in the bile (0.02 gm%) is also consistent with decomposition.

Conclusion: There is evidence supporting smoke inhalation. Fire damage prevents definite assessment of soot deposition within the airway. Although the presence of smoke and debris in the remaining segment of the airway outside the lung tissue could be due to smoke inhalation, I do not think passive deposition of soot into the fire-damaged airway can be definitively excluded. The CO found in the blood does support smoke inhalation. There is no evidence of any lethal injury unrelated to the fire although a gunshot wound of the head cannot be excluded. There is no compelling information suggesting the presence of a gunshot wound. No lethal injuries unrelated to the fire are definitively identified in any of the other persons found in this area. On balance, I believe the evidence indicates she succumbed to the fire.

Cause of Death: Smoke inhalation, thermal burns.

MC 27--Doris Fagan

Ms. Fagan, a 60 year old Black woman (DOB 8/13/32), was found in the area of the first floor hallway. She was found along with 6 other women in this area including her daughter-in-law.

The neck is incinerated resulting in the extensive loss of tissue. Soot and debris are present in the mainstem bronchi. The autopsy diagnoses indicates the presence of moderate soot in the tracheobronchial tree. The right lung is charred. The left upper lobe/lingula is absent. The blood CO saturation is reported as 58%.

Global charring is present. Skull fragments, mostly calcined, include parts of the occipital bone, both temporal bones, left parietal bone and sphenoid bone.

Although gunshot wounds of the chest/abdomen and head cannot be definitively excluded, I think a gunshot of one or both of these areas is unlikely based upon the reconstruction of the tissue fragments and no evidence of damage/hemorrhage of the tissue except related to fire.

The cyanide found in the blood (0.23 mcg/ml) is consistent with decomposition and/or smoke inhalation. The ethanol in the urine (0.02 gm%) and bile (0.02 gm%) are consistent with postmortem production.

Her remains were re-examined in the UK upon repatriation. The UK examination indicates an inability to evaluate the cause of death due to the amount and condition of the tissue available for evaluation.

Conclusion: There is evidence supporting smoke inhalation. The soot deposition in the fire damaged airway may be related to passive deposition. The presence of CO in the blood does support smoke inhalation. There is no evidence indicating or suggesting the presence of any lethal injury unrelated to the fire. None of the other persons found in this area had definite lethal injuries unrelated to the fire. On balance, I believe the evidence indicates she succumbed to the fire.

Cause of Death: Smoke inhalation, thermal burns.

MC 28--Zilla Henry

Ms. Henry, a 55 year old Black woman (DOB 5/21/37), was found in the area of the first floor hallway. She was found along with six other women. Diana (MC 18) and Vanessa (MC 16) Henry were found in the area of the kitchen/serving area. Steven (MC 12) and Phillip (MC 22) Henry were found in the area of the kitchen/stairway.

The neck structures and lungs are absent. The blood CO saturation is reported as 29%.

There is global charring with extensive tissue loss.

Gunshot wounds of the head and chest cannot be excluded.

The cyanide found in the (0.18 mcg/ml) and urine (0.04 mcg/ml) is consistent with decomposition and/or smoke inhalation. The blood (0.01 gm%) and urine (0.02 gm%) ethanol is consistent with decomposition.

Conclusion: Fire damage prevents assessment of the airway for soot deposition. The blood CO does support smoke inhalation. There is no evidence indicating or suggesting the presence of any lethal injury unrelated to the fire although gunshot wounds of the head and chest cannot be excluded. No lethal injuries unrelated to the fire are established in any of the other persons found in this area. On balance, I believe the current information indicates she succumbed to the fire.

Cause of Death: Smoke inhalation, thermal burns.

MC 29--Beverly Elliott

Ms. Elliott, a 27 year old Black woman (DOB 3/30/66), was found in the area of the first floor hallway. She was found along with six other women in this area.

The neck structures and other tissues are incinerated. Only the bases of the lungs are present. The remainder of the lung tissue has been incinerated. No comment about the presence or absence of soot in the residual airways is in the autopsy report. The blood CO saturation is reported as 38%.

There is global charring with extensive tissue loss. Significant portions of the skull are absent.

No evidence of a firearm injury is seen. Gunshot wounds of the head and chest cannot be excluded due to the thermal damage.

The cyanide found in the blood (2 mcg/ml) can be due to decomposition and/or smoke inhalation.

Conclusion: The elevated CO saturation in the blood supports the presence of smoke inhalation. Airway soot deposition could not be assessed due to fire damage. There is nothing to indicate or suggest the presence of a lethal injury unrelated to the fire although gunshot wounds of the head and chest cannot be excluded. No lethal injuries unrelated to the fire are established in any of the other persons found in this area. On balance, I believe the current information indicates she succumbed to the fire.

Cause of Death: Smoke inhalation, thermal burns.

Front of Concrete bunker

Two adult women were found in the area in the front of the concrete bunker. One woman died of smoke inhalation/thermal burns and the other appears to have died of a broken neck.

MC 12--Jennifer Andrade

Ms. Andrade, a 20 year old White woman (DOB 7/17/72), was found in the area of the front of the concrete bunker. Gun barrels are adjacent to the body. She was found with another woman who had died of a broken neck.

Moderate decomposition is present.

There is evidence of smoke inhalation. The proximal trachea is destroyed. There is scant soot in the distal trachea and peripheral bronchi. The lungs are charred, congested and edematous. CO saturation measured in the liver is reported as 43%.

There is global charring with extensive loss of tissue from the extremities. The skull is fragmented. The skull appears relatively intact at the scene except for some possible damage in the right lateral calvarium. The left side of the skull is not well-visualized in the scene photographs. The skull is charred.

Cyanide measured in the blood (0.09 mcg/ml) is consistent with decomposition and/or smoke inhalation.

Conclusion: There is evidence of smoke inhalation including the deposition of soot in the lower portions of the airway. There is no evidence indicating or suggesting the presence of a lethal injury unrelated to the fire.

Cause of Death: Smoke inhalation, thermal burns.

MC 13-Daisy Adina Martin

Ms. Martin, a 41 year old Black woman (DOB 6/6/51), was found in the area of the front of the concrete bunker. She was found along with one other woman who succumbed to the fire.

Moderate decomposition is present.

There are multiple fractures of the cervical spine. The first cervical vertebra has a fracture on the anterior lateral portion between the facet for the dens and the left articular cartilage (19 x 6 mm) resulting in complete separation of two portions of the vertebra. There is also a fracture of C1 on the right lateral portion just posterior to the articular condyle. The C2 dens is fractured obliquely and detached, the left condyle is fractured and somewhat detached and hinged along the vertebral foramen, the right lamina is fractured and the spinous process has multiple comminuted fractures that extend to the inferior surface of the spinous process. There is a small fracture involving the anterior aspect of C3. Radiographs reportedly demonstrate small opacities on C1 and the spinous process of C2.

The anthropologist opined that these fractures may represent a gunshot wound entering below the chin, passing through the cervical spine and foramen magnum into the cranium to most likely exit through the upper right portion of the calvarium. There is a portion of cranium which was thought to display a possible gunshot exit site. No metallic opacities appear on a radiograph of this segment of bone. I do not see any convincing evidence of bullet fragments depicted on the radiographs in the region of the cervical spine damage. A photograph of the remnants of the base of the skull including the foramen magnum show no defects that would establish the presence of a firearm injury. The autopsy report opines the fractures of the neck are related to a fall.

There is global charring with extensive tissue loss. Much of the skull is missing. Portions of the base and posterior calvarium are present. No defects with definite beveling are seen. A gunshot wound of the head or, to a lesser degree, the chest cannot be excluded.

The proximal portion of the trachea is incinerated. The autopsy report indicates no soot was identified in remnants of the distal trachea and lungs. However, the autopsy findings sheet indicates "carbon deposits in the tracheobronchial tree." The blood CO saturation is reported as 37.5%.

Decomposition and/or smoke inhalation can account for the cyanide found in the urine (0.25 mcg/ml). Decomposition can also account for the ethanol in the urine (0.01 gm%).

Conclusion: The exact nature of the neck fractures is not apparent. However, I think that a gunshot wound can be reasonably excluded. The neck fractures are most likely related to the fire. The elevated blood CO saturation is consistent with smoke inhalation. I cannot determine if there was soot deposition within the lower portions of the airway due to conflicting statements in

the autopsy report about this issue. If present, smoke inhalation could have hastened death due to the neck fractures.

Cause of Death: Cervicospinal Blunt Trauma. Death may have been hastened by smoke inhalation.

Top of Concrete bunker

There were nine adults and one teenager found in the area on the top of the concrete bunker. Five deaths, including that of the teenager, were due to gunshots. Three of the firearm deaths were likely caused by someone else, one is consistent with being self-inflicted and there is insufficient information to establish whether the other gunshot could have been self-inflicted. Three of the gunshot victims were shot in the back of the head. Three persons succumbed from the fire and the cause of death of one person was unable to be determined. One person was struck after death by a hand grenade fragment.

MC34-Florecita Sonobe

Ms. Sonobe, a 34 year old Asian woman (DOB 5/11/58), was found along with 8 other persons in the area of the top of the concrete bunker.

There is a gunshot wound of the head. The entry site is not identified and the range of fire cannot be determined. There are extensive fractures of the base of the skull with extension onto the calvarium and palate. The proximal airway is absent. There is inhaled blood in the distal trachea, bronchi and lungs. There is a poorly-defined region of hemorrhage in the brain and an anatomic defect outside the residual basal ganglia and internal capsule. Clotted blood is present in the cerebral ventricular system. There is not enough information available to determine if this wound could have been self-inflicted.

There is global charring with extensive tissue loss. Most of the calvarium above the superior orbital ridges and mid-occiput is absent. A charred segment of right parietal bone is also present. No soot is described in the airways. The "urine" CO saturation is reported as 37.5%. TCMEO toxicologist Dr. Angela Springfield informed the OCS that the toxicology report should indicate the CO was measured in blood and that the "urine" is a clerical error. The cyanide in the urine (0.38 mcg/ml) can be accounted for by decomposition and/or smoke inhalation.

Conclusion: There is a lethal gunshot wound of the head. The features of the wound are those of a low velocity projectile. I would expect more extensive damage to the tissues if the wound track through the brain was caused by a high velocity projectile. There is not enough information upon which to base an opinion as to whether or not the gunshot could have been self-inflicted. The elevated blood CO saturation is consistent with smoke inhalation. However, soot deposition within the airway which would confirm smoke inhalation is lacking. At least one other Davidian decedent having a gunshot wound was found in this area appearing to lack smoke inhalation. If, in fact, she did breath smoke, it cannot be determinated whether or not she was conscious at the time she was breathing the smoke.

Cause of Death: Gunshot Wound of Head.

Manner of Death: Undetermined (Homicide or Suicide).

MC 35-Shari Doyle

Shari Doyle, an 18 year old White woman (DOB 8/1/74), was found in the area of the top of the concrete bunker along with 8 other persons.

There is a gunshot wound of the head. The entrance is probably in the posterior left parietal area (back side of the head) where there is an area of slight internal beveling near the lamboid suture. No estimate of range of fire is possible. The wound track is forward and slightly rightward. The bullet passed through the scalp, skull and brain prior to exiting through the lower forehead slightly to the right of the midline. There are gunshot-related skull fractures. The entry area and path of the bullet would be unusual for a self-inflicted injury. This gunshot was most likely sustained at the hands of another person.

No soot was identified in the trachea. No comment was made in the autopsy report about soot in the portions of the airways within the lungs. CO saturation is reported as 50% in the liver and 44% in the spleen.

There is global charring which is most severe on the posterior aspect of the body.

A green towel is wrapped around the right upper extremity.

Cyanide found in the urine (0.10 mcg/ml) can be accounted for by decomposition and/or smoke inhalation. Decomposition can also account for the ethanol measured in the vitreous (0.01 gm%).

Conclusion: There is a lethal gunshot wound of the head. Insufficient information exists to determine the range of fire. The entry site is not typical of a self-inflicted injury. I believe this injury was most likely inflicted by another person. There is some evidence supporting smoke inhalation. Elevated CO saturations were measured in the liver and spleen. However, the interpretation of CO saturation involving visceral organ tissues is difficult, especially when decomposition is present. The lack of identifiable soot in the lower portions of the airway weighs against smoke inhalation. At least one other Davidian decedent having a gunshot wound was found in this area appears not to have inhaled smoke.

Cause of Death: Gunshot Wound of Head.

MC 36-David Jones

Mr. Jones, a 38 year old White male (DOB 10/17/45), was found along with 8 other persons in the area of the top of the concrete bunker.

There is a gunshot wound of the head. The bullet entered through the back of the head. The exact entry site is not identified due to the thermal damage to the skull. No estimation of the range of fire is possible. The bullet passed forward through the head to exit the midline in the frontal area creating an externally beveled defect having a 14 mm internal surface diameter. The bullet track through the brain was obscured by the effects of fire. Patchy hemorrhage was present on the surface of the brain. The entry site and path of the bullet indicate it would be unlikely that this wound was self-inflicted. This wound was most likely received at the hands of another person.

The autopsy report indicates no soot was identified in the airway. The toxicology report indicates no CO was identified in the blood. However, the case summary sheet indicates a blood CO saturation of 17%.

There is global charring with loss of tissue.

The cyanide (1.32 mcg/ml) and ethanol (0.01 gm%) found in the urine can be accounted for by decomposition.

Conclusion: The range of fire of the gunshot wound that entered the back of the head cannot be determined due to the effects of the fire. However, the entry site is not typical of a self-inflicted injury. The gunshot was most likely sustained at the hands of another person. The features of the wound indicate a low velocity projectile. I would expect more damage if the wound was due to a high velocity projectile. Although the case summary report indicates the presence of CO in the blood, the actual toxicology report indicates no CO was found in the blood. The lack of CO correlates with the absence of soot deposition in the airways. On balance, the currently available information supports the absence of smoke inhalation.

Cause of Death: Gunshot Wound of Head.

MC37-Alrick Bennett

Mr. Bennett, a 35 year old White man (DOB 7/23/67), was found in the area of the top of the concrete bunker along with 8 other persons.

The internal organs are relatively well-preserved.

There is evidence of smoke inhalation. The trachea contains a small amount of soot. Scant soot is also found in the distal airways. The lungs are congested. The blood CO saturation is reported as 24%.

There is global charring. Fire-related fractures of the skull are present.

There is blood (approximately 40 grams) mixed with soot and debris extending from the nares to the upper trachea. Blood is also present in the sphenoid sinus. No discrete injuries unrelated to the fire are identified. No intracranial hemorrhage is present. No evidence of a firearm injury is seen.

The cyanide measured in the blood (0.43 mcg/ml) is consistent with decomposition and/or smoke inhalation.

The repatriated remains were re-examined subsequent to their arrival in the UK. The UK examination of the body was unable to verify the TCMEO-stated cause of death because the condition of the tissue available for evaluation did not allow confirmation of smoke inhalation. The UK firearms expert indicated the presence of massive injury to the left frontal rib cage and the presence of numerous small radio-opaque objects in the body which he felt were likely due to an explosion of a grenade or some other item of explosive ordnance.

Neither the UK nor the TCMEO examiners indicate massive damage to the front of the left rib cage. There is some fire damage to the left posterolateral ribs. There is extensive fire damage to the front of the right chest. None of the pathologists or the anthropologist described any damage other than fire-related damage. The visceral organs were reasonably well-preserved at the time of the initial examination. The organs and body cavities showed no evidence of any blast effect, shrapnel defects or hemorrhage. No grenade fragments were recovered from the viscera. Radio-opaque debris is widespread among the bodies recovered from the burned structure. I do not see any evidence to suggest the extensive damage seen on this body is related to the explosion of a grenade or other explosive device. As noted above, the evidence to the contrary is substantial.

Conclusion: The elevated blood CO saturation and the deposition of soot in the lower portions of the airways indicates smoke inhalation. No lethal injury unrelated to the fire is identified. No compelling information suggesting the presence of some other lethal injury is present.

Cause of Death: Smoke inhalation, thermal burns.

MC 38–Rebecca Saipaia

Ms. Saipaia, a 24 year old White female (DOB 7/13/68), was found along with 8 other persons in the area of the top of the concrete bunker. A "Quant" brand watch that had stopped at 12:20 was present. A large hunting knife was adjacent to the body.

The visceral organs are relatively well-preserved.

There is evidence of smoke inhalation. Patchy deposition of soot is identified in the left lung airways. The left lung is edematous. The right lung is extensively burned. CO was not identified in the blood.

There is global charring. The base of the skull is intact. The calvarium is fragmented, collapsed and portions are missing. There is outward bursting of bone flaps which is a typical finding in heat-related skull fractures.

No evidence of a gunshot wound is seen. A gunshot wound involving the right chest or head cannot be definitively excluded due to the burning.

Toxicologic evaluation indicates the presence of cyanide in the urine (0.20 mcg/ml) which is consistent with decomposition and/or smoke inhalation. Decomposition can account for the ethanol measured in the blood (0.02 gm%).

Conclusion: The presence of soot deposition within the lower portions of the airway indicates smoke inhalation even though CO was not identified in the blood. There is no demonstrable lethal injury unrelated to the fire. There is no compelling information that suggests the presence of some other lethal injury although a gunshot wound involving the right chest or the head cannot be definitively excluded.

Cause of Death: Smoke inhalation, thermal burns.

MC 39–Novellette Hipsman

Ms. Hipsman, a 36 year old Black woman (DOB 5/2/56), was found along with eight other persons in the area of the top of the concrete bunker. The body was face down at the fire scene. A Timex watch stopped at 1:00 was present. There was a gas mask with the filter in two pieces. Both pieces of the filter were melted to her shirt and jacket.

There is a gunshot wound of the head. The bullet entered the right lower back of the head (10 mm defect) 15 mm to the right of the midline. The range of fire cannot be determined. The bullet passed forward and slightly leftward to transect the brainstem prior to exiting the skull through the cribriform plate/septum. There is prominent hemorrhage in the posterior cranial fossa and within the ventricular system. There are gunshot-related fractures of the left maxillary sinus and left frontal bone. The lungs are congested and edematous. This wound resulted in immediate incapacitation. The wound site would be very atypical for a self-inflicted injury and was, in reasonable probability, sustained at the hands of another person.

There is a gunshot wound of the chest. The entry site is not identified. No range of fire determination can be made. The wound track involves the anterior right first intercostal space, left lung upper lobe, heart (guttering along anterior wall of the right ventricle), left diaphragm, left lobe of the liver, gastric cardia to a large charred defect of the left lateral abdominal wall. There are fractures at the lower left 11-12 ribs. The left chest cavity contains 250 g of blood. The entry site and track of this bullet are atypical for a self-inflicted wound and in reasonable probability is a wound inflicted by another person.

There is no clear evidence of smoke inhalation. No soot is described in the airways. The blood CO saturation is reported as 3.75%. If it accurately reflects antemortem CO saturation, the CO source could be smoke (structural fire or tobacco).

There is global charring.

The cyanide found in the urine (0.44 mcg/ml) can result from decomposition and/or smoke inhalation. The ethanol in the blood (0.02 gm%), bile (0.02 gm%), vitreous (0.03 gm%) and urine (0.01 gm%) is consistent with postmortem production.

Conclusion: The gunshot wound of the head that transected the brainstem would be immediately incapacitating and I would expect it to be very rapidly lethal. The gunshot wound of the chest would not necessarily be immediately incapacitating, but I would expect incapacitation and death to occur in a relatively short period of time. Both wounds appear to have been caused by low velocity bullets. I would expect more damage if the projectiles were high velocity. The range of fire cannot be determined for either gunshot. The gunshots are not typical of self-inflicted injuries and I believe they were sustained at the hands of another person. She was alive when she received both shots as evidenced by the hemorrhage associated with the damage resulting from each projectile. Evidence for smoke inhalation is relatively weak. There is a

slight increase in the reported blood CO saturation. Confirmatory soot deposition within the lower portions of the airways is lacking. On balance, I'm not convinced she breathed smoke from the fire but I cannot definitively exclude the possibility she breathed a small amount of smoke. At least one other Davidian decedent dying of a gunshot wound was found in this area who appears not to have inhaled smoke.

Cause of Death: Gunshot Wound of Head.

MC 40-Gregory Summers

Mr. Summers, a 28 year old White man (DOB 1/9/65), was found along with eight other persons in the area of the top of the concrete bunker.

There is global charring. The majority of the head/skull is burned away. Some fragments of the skull are present. The segment of base that is present is not fractured. The neck and chest/abdomen walls are incinerated.

No definite airway soot is documented. The blood CO saturation is reported as 20%.

No gunshot wounds are identified. Thermal damage does not allow a gunshot wound of the head to be excluded.

A metal fragment consistent with a hand grenade was collected as evidence. No wound track or hemorrhage related to the fragment is described in the autopsy report. The body appears to have been struck by the shrapnel after death.

Cyanide found in the blood (0.40 mcg/ml) and urine (0.30 mcg/ml) is consistent with decomposition and/or smoke inhalation. Decomposition can account for the ethanol found in the blood (0.02 gm%), bile (0.03 gm%) and urine (0.02 gm%).

Conclusion: The presence of elevated blood CO saturation is consistent with smoke inhalation. However, the confirmatory deposition of soot in the lower portions of the airway is lacking. Fire damage prevents adequately excluding a gunshot wound involving the head. In addition, there are other decedents found in this area who clearly had sustained lethal gunshot wounds. The grenade fragment appears to have struck the body after death. On balance, I do not think the currently available information allows the cause of death to be identified.

Cause of Death: Undetermined.

Manner of Death: Undetermined (Homicide or Suicide).

MC 41-Neru Neil Vaega

Mr. Vaega, a 36 year old Pacific Islander man (DOB 12/25/55), was found along with 8 other persons in the area of the top of the concrete bunker.

The autopsy report indicates a gunshot wound of the head. The entry site is in the right forehead just to the right of the midline. Soot is deposited circumferentially around the wound. The wound is a contact/near-contact wound. The bullet passed backward, rightward and downward through the head to exit through the right occipital area. The lungs are congested and edematous. A large amount of blood is in the airways. The base of the skull and most of the calvarium were intact at the time of the initial TCMEO examination.

The anthropology examination reports fragmentation of the cranium. It also indicates all the trauma observed is consistent with being due to heat. The anthropology examination was performed 4 days after the autopsy examination. Autopsy-related fragmentation of the fragile skull may account for the apparent discrepancy between the autopsy and anthropology examinations.

The scene photographs demonstrate extensive burning of the skull; however, at least the front and left sides appear relatively intact. The photographs demonstrate a defect in the frontal area to the right of the midline. The photographs do not demonstrate this area in enough clarity to allow independent analysis of the characteristics of the defect. Photographs of the exit site described in the autopsy are not available.

There is evidence of smoke inhalation. Dense soot is present in the airways. The lungs are congested and edematous. The blood CO saturation is reported as 66%.

There is global charring.

The death certificate indicates the cause of death as smoke inhalation and does not mention a gunshot wound. The autopsy protocol indicates the cause of death as a gunshot wound and global charring.

The cyanide found in the blood (0.20 mcg/ml) and bile (0.07 mcg/ml) is consistent with decomposition and/or smoke inhalation.

Conclusion: There is a contact/near-contact gunshot wound that entered the right lower forehead and exited through the right occipital (back) of the head. The features of the wound indicate a low velocity projectile. I would expect more damage if a high velocity projectile perforated the head. The wound is consistent with being self-inflicted. However, the wound could also have been caused by someone else. The wound was probably immediately incapacitating. The copious soot deposition in the airways and the elevated blood CO saturation indicate smoke inhalation. Smoke inhalation may have hastened death. I cannot determine if he was conscious when he began breathing smoke from the fire.

Cause of Death: Gunshot Wound of Head. Smoke inhalation may have hastened death.

Manner of Death: Undetermined (Suicide or Homicide).

MC 42-Pablo Cohen

Mr. Cohen, a 28 year old White man (DOB 10/6/64), was found along with 8 other persons in the area of the top of the concrete bunker.

There is evidence of smoke inhalation. A large amount of soot, dirt and debris are present in the intact tracheobronchial tree. Soot, dirt and debris are also found in the esophagus. CO saturation was measured in the liver (50%) and spleen (37.5%).

There is global charring. Heat-related fractures are present.

There is no evidence of a gunshot wound.

The cyanide in the urine (0.06 mcg/ml) is consistent with decomposition and/or smoke inhalation.

Conclusion: The deposition of soot and other debris in the intact airway indicates smoke inhalation. Smoke inhalation is further supported by the material deposited in the esophagus and the elevated CO saturation (see toxicology section discussion regarding CO interpretation). No lethal injuries unrelated to the fire are identified.

Cause of Death: Smoke Inhalation, thermal burns.

Concrete Bunker Surface

There were four adults, one older teenager and two young children recovered on the surface in the concrete bunker. Two of the women were pregnant with fetuses fathered by David Koresh. One adult, the older teenager and a young child died of firearm injuries. One child died of a stab wound and three adults succumbed from the fire. Other bodies were recovered under debris in the bunker.

MC30-Katherine Andrade

Ms. Andrade, a 24 year old White woman (DOB 7/19/68), was found along with 6 other persons on the surface in the concrete bunker. Her daughter, Chanel Andrade (MC 62), was found in the concrete bunker.

Decomposition is moderately advanced.

There is evidence of smoke inhalation. Prominent soot deposition is present within the lungs' airways. The better preserved portions of the lungs are congested and edematous. The neck structures are absent. The blood CO saturation is reported as 15%. A portion of the "blood" specimen appears to have been obtained from the decomposing left chest contents.

There is global charring with extensive tissue loss.

A blood clot (13 x 10 x 7 cm) is reported to be present in the left chest cavity but no injuries unrelated to the fire are identified in this area or in other areas. The sternum, anterior ribs and soft tissues have been destroyed by fire and the lungs are burned. A gunshot wound cannot be definitively excluded.

The cyanide found in the blood (1.05 mcg/ml) can be attributed to decomposition and/or smoke inhalation.

Conclusion: The airway soot deposition indicates smoke inhalation. The elevated CO saturation is also consistent with smoke inhalation. No definite injuries unrelated to the fire are identified. I do not see any compelling evidence suggesting the presence of a gunshot wound. The "blood clot" described in the left chest cavity may be an artifact of decomposition of the markedly congested lung tissue.

Cause of Death: Smoke inhalation, thermal burns.

MC 31A-Aisha Summers

Ms. Summers, a 17 year old White woman (DOB 10/4/75), was found along with 6 other persons on the surface in the concrete bunker. Garb included a military web belt with attached ammunition pouch, knife scabbard, and a portion of an apparent gun cleaning kit.

There is marked decomposition. The heart, great vessels and lungs are not seen.

There is multifocal charring with tissue loss. Only portions of the posterior fossa and left middle fossa of the skull remain.

There is a gunshot wound of the chest. The entry site is obscured by decomposition and loss of soft tissue. The entrance is probably on the anterior/anterolateral left chest where there is an internally beveled fracture along the superior edge of the ninth rib. The wound track is upward, backward and rightward. No range determination is possible. Hemorrhage is present in the left chest, mediastinum and midesophageal area. The right second rib is fractured 86 mm from its sternal end. The entry site and wound track would be unusual for a self-inflicted injury. This injury was most likely sustained at the hands of another person.

No lung tissue was identified so airway assessment of soot deposition is not possible. The CO saturation measured in the liver is reported as 52.5%. It cannot be determined if the liver CO reflects antemortem CO exposure or if it is a false positive laboratory value related to decomposition (see toxicology section discussion regarding CO interpretation).

There is a 1 1/4 inch postmortem depressed fractured on the right posterior aspect of the skull. The left base of the skull is also fractured.

There is a postmortem injury over the left scapula. The surface wound has an irregular margin with marked soot deposition on the edges. No defect is present in the bone. This wound is consistent with heat-induced explosion of unchambered ammunition ("cooked off" round).

A gunshot wound of the head cannot be excluded due to the thermal effects. Only a portion of the base of the skull is present.

A near-term (8 ½-9 months gestation) fetus (**MC 31B/58**) is present. Based on the gestational age the fetus would be considered viable. DNA studies link this fetus to David Koresh (MC-8).

The ethanol detected in the bile (0.04~gm%) and liver (0.05~gm%) is consistent with postmortem production. The cyanide measured in the bile (0.05~mcg/ml) is consistent with decomposition and/or smoke inhalation.

Conclusion: The features of the gunshot wound of chest entrance are primarily obscured by decomposition. The range of fire cannot be determined. The features of the wound indicate it was caused by a low velocity projectile. I would expect more damage if a high velocity projectile caused the injury. The entry site and wound track would not be typical of a self-inflicted injury. The gunshot was likely caused by another person. Decomposition prevents adequate assessment for smoke inhalation. Postmortem defects caused by heat-related explosion of ammunition are present. The fetus is nearly full term and I would expect it to be viable. The fetus died as the result of the death of the mother. No direct mechanical injury to the fetus is apparent.

Cause of Death: Gunshot Wound of Chest.

MC 31DE-Unidentified

The limited remains of this 11-14 year old child were found on the surface in the concrete bunker along with 6 other individuals.

The remains are limited to a fragmented skull including the mandible. No DNA analysis was performed.

There are two gunshot wounds. One gunshot entry is in the left temporal bone. This defect is relatively round and 6 mm in diameter. The wound track is rightward. The exit site is not identified. An estimate of the range of fire is not possible. It cannot be established on the basis of the currently available information if this wound could have been self-inflicted.

The other gunshot is at the left zygomaxillary border (7.5 mm). Bone fragments are deeply displaced and there is slight internal beveling. Soot is described on the margins of the wound. The wound is a contact/near-contact wound. The posterior left maxillary sinus is broken away and is probably the exit site. The location of this entry site is not typical of a self-inflicted wound and was most likely inflicted by another person.

There is also an 18 x 14 mm depressed fracture of the right occiput which is hinged inferiorly and has the superior end displaced towards the midline. The exact mechanism through which this fracture was sustained is not apparent.

Conclusion: There are two gunshot wounds. One projectile entered through the left temporal bone and the other entered the left face. The left face wound is a contact/near-contact wound and is not typical of a self-inflicted gunshot. I believe this person was most likely shot by another individual. The wounds appear to have been caused by low velocity projectiles. I would expect more extensive damage if high velocity projectiles caused the injuries. The cause of the fracture involving the back of the skull (occipital bone) is not apparent. No assessment of smoke inhalation is possible.

Cause of Death: Gunshot Wound of Head.

MC 31C-Male distal right leg with foot (not further described)

There is some burning and charring of the fractured ends of the tibia and fibula.

This portion of an extremity was not matched with any particular body. No DNA studies were performed. No photographs are available. There is currently not enough information to match this fragment with a particular body.

MC 32–John McBean

Mr. McBean, a 27 year old Black man (DOB 9/23/65), was found along with 6 other persons on the surface in the concrete bunker.

There is evidence of smoke inhalation. A large amount of smoke deposition is present in the tracheobronchial tree. The neck structures are absent. The lungs are acutely congested and edematous. The blood CO saturation is reported as 46%.

There is global charring with much tissue loss including the anterior chest/abdomen wall. The internal organs are exposed and charred but appear intact. The head is absent.

No gunshot wounds are identified. A gunshot wound of the head cannot be excluded due to the thermal damage.

The cyanide found in the blood (0.05 mcg/ml) and urine (0.02 mcg/ml) can be related to decomposition and/or smoke inhalation. The ethanol in the urine (0.02 gm%) is consistent with postmortem production.

Conclusion: The smoke in the lower portions of the airway indicates smoke inhalation. The elevated blood CO saturation also supports smoke inhalation. No lethal injuries unrelated to the fire are identified. Although a gunshot wound to the head cannot be excluded, there is no compelling information suggesting the presence of a gunshot wound. The lack of blood in the airways supports the lack of damage to the base of the skull, which often accompanies a gunshot wound of the head.

Cause of Death: Smoke inhalation, thermal burns.

MC 33/47B-Dayland Little (Gent)

Dayland Little is a 3 year old White male (DOB 7/22/89) who was found along with 6 other persons, including his mother, Nicole Little (MC 47), on surface in the concrete bunker.

There is a stab wound of the left chest. There are cuts on adjacent left ribs in the mid-axillary line. There is a "considerable quantity" of apparently localized blood in the upper left chest. Blood is apparently present at the decomposed lung. This stab wound was inflicted by another person.

There were no large airways available to assess for the presence of soot. An observation of a possible minimal amount of soot within severely decomposed lung tissue was made. No toxicologic testing for CO was apparently performed.

Extensive charring is present.

No gunshot wounds are observed. Although a gunshot wound of the head cannot be categorically excluded, I think it is unlikely that there is a gunshot wound. The likely sites for involvement of a gunshot of the head are intact.

Conclusion: There is a stab wound of the chest that was inflicted by another person. Postmortem changes prevent adequate assessment for smoke inhalation. The description of a "possible minimal amount" of soot within decomposing lung is not sufficient to definitively establish that soot was present within the airways.

Cause of Death: Stab Wound of Chest.

MC 47–Nicole Little (Gent)

Ms. Little (Gent), a 24 year old White woman, was recovered along with 6 other individuals, including her son, Dayland Little (MC 33/47B), on the surface in the concrete bunker. Her other child, Pages Gent (MC 64), was found in the concrete bunker.

There is a shotgun wound of the head. The entry site is not identified. Most of the calvarium is absent. There are multiple fragments of the skull with variable burning adjacent to the body. The base of the skull is extensively fractured. Shotgun pellets (1.5-2 mm) with faceting are present in brain tissue found within and adjacent to the body. The large airways and the peripheral airspaces contain blood due to massive aspiration. Left scalp hair is matted with apparent dried blood and contains 2 pellets. The extent of the damage indicates that the gun was discharged close enough to the decedent so the pellets would not have spread extensively prior to striking the person. It cannot be determined if the wound was self-inflicted or was received at the hands of another person.

There is no evidence of smoke inhalation. No soot is described in the airways. The neck structures are absent. No CO was detected in the blood.

There is global charring with extensive loss of tissue. The base of the skull is present. The skull vault, orbits, nasal bone and portions of the mandible/maxilla are absent. Other separate bone fragments are also present. The anterior chest soft tissue and the lateral right chest wall are absent.

A fetal skeleton (**MC 47C**) was recovered from the soft tissues of the upper left thigh. The fetus was extruded from the burned uterus and through a fire-induced abdominal defect. The gestational age of the fetus is 16-18 weeks. A fetus at this stage of development is non-viable. DNA studies link this fetus to MC 47 (Nicole Little [Gent]) and MC 8 (David Koresh).

The urine ethanol (0.03 gm%) is consistent with decomposition.

Conclusion: The shotgun wound of the head was received at a range short enough that there was not extensive pellet spread prior to the pellet column striking her head. There is not enough information available to determine if the shotgun wound could have been self-inflicted. There is no evidence of smoke inhalation. The fetus was not viable and died due to the death of the mother. No direct mechanical damage to the fetus is identified.

Cause of Death: Shotgun Wound of Head.

Manner of Death: Undetermined (Homicide or Suicide).

MC 49--Wayne Martin

Mr. Martin is a 20 year old Black man (DOB 1/5/73) who was found along with 6 other persons on the surface in the concrete bunker.

There is moderate decomposition.

There is evidence of smoke inhalation. A small amount of soot is present in the larynx and lung bronchi. Blood CO saturation is reported as 46%.

Global charring is present. The head and torso are intact.

There is no evidence of any gunshot wounds.

Ethanol found in the urine (0.03 gm%) can be attributed to decomposition.

Conclusion: There is smoke inhalation as evidenced by the presence of soot within the lower portion of the airway and an elevated saturation of CO in the blood. No evidence of any lethal injuries unrelated to the fire is identified.

Cause of Death: Smoke inhalation, thermal burns.

Concrete bunker

There were 5 adults and 23 children recovered in the debris in the concrete bunker. Most of the young children were found in this area. At least one adult and three children were killed by gunshots. One adult and 6 children succumbed from the fire. Two children died of blunt injuries. The causes of deaths of 3 adults and 12 children cannot be determined. The inability to determine the causes of the deaths of most of these individuals is due to the effects of the fire and decomposition.

Area Farthest From Cooler

MC 51--Judy Schneider

Ms. Schneider, a 41 year old White woman (DOB 9/20/51), was found along with 27 other persons, including her daughter (MC 51A/70), in the concrete bunker.

There is marked decomposition of the viscera.

There is a perforating defect through the right hand consistent with a gunshot wound. There appears to be some hemorrhage associated with the wound. Investigative reports indicate she had received a gunshot wound involving the right hand on February 28, 1993. This wound appears to have been caused by a low velocity projectile. I would expect significantly more damage if the wound would have been caused by a high velocity projectile.

There is a fracture of the right tenth rib, 56 mm from the vertebra. There is a small amount of blood (30 g) in the right chest cavity. This injury is consistent with perimortem blunt trauma.

No evidence of smoke inhalation is identified. Soot deposition within the airways could not be assessed due to the postmortem changes. No CO was identified in the blood.

There is global charring with extensive tissue loss including the skull, portions of the upper spine, extremities and chest. The left lung is charred.

Gunshot wounds of the head and chest cannot be excluded.

Decomposition can account for the ethanol (0.01 gm%) and cyanide (0.12 mcg/ml) found in the blood.

Conclusion: There is insufficient information available to determine the cause of death. No definite antemortem lethal injuries are identified. Postmortem changes prevent an adequate assessment for smoke inhalation. A lethal gunshot wound cannot be excluded. She does have a non-lethal gunshot wound involving the right hand which she apparently received on February 28, 1993.

Cause of Death: Undetermined.

Manner of Death: Undetermined (Homicide or Suicide).

MC 52--Joseph Martinez

Joseph Martinez, an 8 year old Hispanic male (DOB 4/21/84), was found along with 27 other persons, including many children, in the concrete bunker. His mother, Juliet Martinez (MC 54), and other family members (MC 53, 55, 56, 57) were among the decedents found in this area.

There is advanced decomposition.

There is evidence of smoke inhalation. The airways contain a large amount of soot. The blood CO saturation is reported as 72.5%. The lungs are congested and edematous.

There is extensive burning; however, the body is relatively intact. Fire-related fractures of the skull are present. There is absence of portions of the skull including the posterior frontal and parietal bones. The brain is intact.

There is no evidence of a gunshot wound. The "summary sheet" accompanying the autopsy indicates the presence of a lethal gunshot wound of the torso. However, the autopsy report description and findings do not indicate any gunshot wound. The summary report also does not indicate death due to a gunshot.

The cyanide found in the blood (0.07 mcg/ml) and bile (0.10 mcg/ml) is consistent with decomposition and/or smoke inhalation. The ethanol measured in the blood (0.14 gm%) and bile (0.03 gm%) is also consistent with decomposition.

Conclusion: The presence of soot in the lower airways indicates smoke inhalation. The elevated blood CO saturation is also consistent with smoke inhalation. There is no evidence to indicate or reasonably suggest the presence of any lethal antemortem injury unrelated to the fire.

Cause of Death: Smoke inhalation, thermal burns.

MC 53--Isaiah Martinez

Isaiah Martinez, a 5 ½- 6 ½ year old Hispanic male, was found along with 27 other persons, including many children, in the concrete bunker. His mother, Juliet Martinez (MC 54), and other family members (MC 52, 55, 56, 57) were among the decedents found in this area.

There is marked decomposition.

There is a gunshot wound of the left chest. The clothing has 3 circular perforations on both sides of the zipper in the midline over the heart area. The garment demonstrates burning. Definitive range determination cannot be made on the basis of the currently available information. The entry site into the body is obscured by the decomposition. There is a 7 x 4 mm soft tissue defect at the anterior left sixth rib. The defect along the superior edge of the rib is internally beveled. There is some black discoloration of the rib defect which is due to deposition of material later identified as lead. No heat damage to the ribs is present. The wound track is backward and downward. The bullet passed through the left lung lower lobe (10 mm) where there is hemorrhagic fluid. The exit site is not identified and is probably obscured by decomposition. No projectile is identified in the body.

There is evidence of smoke inhalation. The pulmonary airways contain soot. CO saturation in the liver is reported as 37.5%. The lungs are congested and edematous.

Marked charring is present. The neck structures are absent.

Conclusion: There is a gunshot wound of the chest that damaged the left lung. Hemorrhage along the wound indicates he was alive when he received the wound. The wound was received at the hands of another. The range of fire cannot be determined. The wound was caused by a low velocity projectile. More damage would be expected if a high velocity projectile caused the injury. The presence of soot in the lower portions of the airway indicates smoke inhalation. The significance, if any, of the liver CO is difficult to determine (see toxicology section discussion regarding CO interpretation). The effects of the fire may have contributed to death.

Cause of Death: Gunshot wound of chest. The effects of the fire may have hastened death.

MC 54--Juliet Martinez

Ms. Martinez, a 30 year old Hispanic female, was found along with 27 other persons, her children (MC 52, 53, 55, 56, 57) among them, in the concrete bunker.

Relatively mild decomposition is present.

There is evidence of smoke inhalation. Moderate soot is found in the airways. The blood CO saturation is reported as 33%. The lungs are congested.

There is light-moderate charring of the face, upper neck and distal upper extremities.

No evidence of gunshot wounds is present. There is blood (50 g) in the right pleural space. However, no evidence of injury to the lung or to the chest/abdominal wall is identified.

The blood ethanol (0.11 gm%) is consistent with decomposition.

Conclusion: The presence of soot deposition within lower portions of the airway indicates smoke inhalation. The elevated blood CO saturation is consistent with smoke inhalation. No antemortem lethal injuries unrelated to the fire are identified. The exact source of the small amount of bloody material in the chest cavity is not apparent. The blood is not convincing evidence of an antemortem injury and may represent a postmortem artifact. There is no compelling information suggesting the presence of any other lethal injury.

Cause of Death: Smoke inhalation, thermal burns.

MC 55--Audrey Martinez

Audrey Martinez, a 13 year old Hispanic female (DOB 1/23/80), was found along with 27 other persons, including many children, in the concrete bunker. Her mother, Juliet Martinez (MC 54), and other family members (MC 53, 53, 56, 57) were among the decedents found in this area.

Marked decomposition is present.

The right lower chest has a moderate amount of clotted blood.

There is a 12 mm low velocity compression fracture of the anterior right maxilla. It cannot be determined if the wound was received before or after death.

There are avulsion injuries of the lateral right 8-9 ribs that are consistent with being received postmortem.

There is a small amount of clotted blood in the nasopharynx and right middle cranial fossa. The blood in the head is probably a postmortem artifact. The calvarium and base of the skull are intact. Blood in the nasopharynx is a non-specific finding. It could be secondary to trauma or agonal congestion with extravasation.

Exposed body surfaces demonstrate charring.

There is no evidence of smoke inhalation. The neck organs appear absent. The lungs are amorphous masses of tissue due to decomposition. No CO was detected in the blood.

The ethanol found in the blood (0.04 gm%) is consistent with decomposition. The acetone (0.02 gm%) detected in the blood was also likely related to decomposition.

Conclusion: The presence of marked decomposition prevents adequate assessment for smoke inhalation. No definite antemortem lethal injuries are identified. Although suffocation due to overlaying or a chest injury related to being struck may have caused death, on balance I do not think there is enough information to confirm a particular cause of death. However, it does appear that her death was most likely related to the effects of the fire.

Cause of Death: Undetermined.

MC 56--Abigail Martinez

Audrey Martinez, an 11 year old Hispanic female (DOB 5/29/81), was found along with 27 other persons, including many children, in the concrete bunker. Her mother, Juliet Martinez (MC 54), and other family members (MC 52, 53, 55, 57) were among the decedents found in this area.

There is advanced decomposition.

There is at least one gunshot wound, and probably two, involving the head. The available photographs are not sufficient for me to definitively resolve this issue.

There is an entrance wound in the posterior portion of the left temporal bone. The left temporal defect is 3/8 x 1/4 inch and has some possible slight internal beveling. The autopsy report indicates the bullet creating this wound exited through the left maxilla. Although possible, this would be a somewhat unusual wound track to be associated with the relatively uniform appearance of the entry site. I think the left temporal entry site is most likely associated with an exit defect of the right side of the calvarium. The right side of the calvarium is absent.

The anthropologist described a penetrating injury of the left maxilla at the border of the palatine bone that has an interiorly directed hinged segment of bone. The wound suggested to the anthropologist a likely site of entry in the upper nasal area. A large blood clot is present in the left chest cavity. The left lung and heart are absent and the right lung is partially charred. The right chest wall is charred. I think there is most likely a second gunshot that entered the body in the upper nasal area, created the maxillary defect and then continued to pass downward into the chest.

The range of fire of either gunshot cannot be established with certainty. The wounds were likely sustained at the hands of another person.

There is no evidence of smoke inhalation. No soot is identified in the periphery of the right lung. No CO was detected.

Burning, as noted above, is present.

There is a 4 mm cut on the posterior distal left ulna.

Ethanol (0.28 gm%) and acetone (0.03 gm%) were detected in the blood. Although the amount of ethanol found in the blood is higher than usually associated with decomposition, occasionally decomposition results in the production of relatively large amounts of ethanol. Overall, I think the ethanol and the acetone in this case are most likely related to postmortem production.

Conclusion: There are gunshot wounds involving the head and probably the left chest. Postmortem changes obscure many of the features of these wounds. No range of fire determination can be determined. The wounds were likely sustained at the hands of another person. There is no evidence of smoke inhalation. The source of the small cut involving one of the bones of the left forearm is not apparent.

Cause of Death: Gunshot Wound of Head.

MC 57--Crystal Martinez

Audrey Martinez, a 6 year old Hispanic female, was found along with 27 other persons, including many children, in the concrete bunker. Her mother, Juliet Martinez (MC 54), and other family members (MC 52, 53, 55, 56) were among the decedents found in this area.

There is moderate decomposition.

There is some evidence of smoke inhalation. The trachea and bronchi contain bloody debris mixed with a variable, generally small, amount of soot. The lung tissue is congested and autolyzed. No toxicologic data is available.

No definite burning of the body is noted. Soot is present on the surface of the body.

No evidence of lethal firearm, sharp or blunt force injuries is seen. The body is intact.

Conclusion: The cause of death cannot be determined with adequate certainty. Death is most likely related to smoke inhalation; however, the lack of toxicologic data coupled with the small amount of soot deposition does not allow this diagnosis to be established with sufficient certainty. Overlaying cannot be definitively excluded. On balance, death is most likely the related to the effects of the fire.

Cause of Death: Undetermined.

MC 60--Unidentified

This unidentified 2-5 year old child was found along with 27 other persons, including several other children, in the concrete bunker.

The remains consist of a left humerus and a mandible that were co-mingled with MC-63. There is no matching DNA profile among the other remains that were analyzed. No evidence of trauma is seen.

Conclusion: There is insufficient information to determine the cause of death. Most of the vital structures of the body are not available for examination. The only reasonable cause of death is either at the hands of another or due to the effects of the fire.

Cause of Death: Undetermined.

MC 61 and MC 50--Martin child

The remains of an adolescent Martin female were recovered along with the remains of 27 other individuals, including several children, in the concrete bunker. DNA analysis established that she was a Martin child. Her father, Douglas Martin (MC 5), was found in the area of the rear of the chapel. Her sister was found in the area of the hallway (MC 26).

There is extensive thermal damage and decomposition. The torso is disrupted and the head is absent. The viscera are partially absent and the remaining viscera are decomposed.

No assessment for smoke inhalation is possible. The respiratory system structures are not available to examine for soot. No toxicologic data is available.

Antemortem injuries to the head and torso cannot be excluded due to the fire damage.

Shearing injuries to the pelvis, left femur and right humerus are present. It cannot be determined if these are antemortem or postmortem.

The repatriated remains were re-examined in the UK. The UK evaluation (MC 61) indicates an inability to evaluate the cause of death or to confirm smoke inhalation due to the amount and condition of the tissue available for evaluation.

Conclusion: The available information is insufficient to determine the cause of death. No assessment for smoke inhalation is possible. No definite antemortem lethal injuries are identified. Some vital structures are not available for evaluation.

Cause of Death: Undetermined.

Manner of Death: Undetermined (Homicide or Suicide).

MC 63--Jones Twin

This 1 ½ year old White female was recovered along with the remains of 27 other persons, including several children, in the concrete bunker. Her mother, Michelle Thibodeau (MC 71), and sisters (MC 72, 73) were also found in this area.

There are blunt force injuries of the head and chest. There is extensive fracturing and collapse of the posterior calvarium. There is subgaleal hemorrhage in the posterior right parietal area. There is a fracture of the lateral left tenth rib associated with a chest wall hematoma and a defect in the garment. An anterior right rib is fractured. These injuries are probably due to falling debris.

Burning of the calvarium is present.

The respiratory system is not available to evaluate for the presence of soot. The CO saturation in the liver is reported as 46%. It cannot be established if the liver CO accurately reflects antemortem CO content or if it is a false positive laboratory value related to the effects of decomposition (see toxicology section discussion regarding CO interpretation).

There is a probable postmortem parietal skull fracture due to shrapnel.

A gunshot wound involving the chest/abdomen cannot be excluded. Even though portions of the skull are absent, I think a gunshot wound of the head can reasonably be excluded.

Conclusion: The blunt trauma to the head and chest are likely related to falling debris. The hemorrhage associated with the injuries indicates the child was alive when the chest injury was received. An adequate evaluation for smoke inhalation is not possible. The child appears to have been struck by shrapnel after death.

Cause of Death: Blunt trauma to the head.

MC 70 / 51A--Mayannah Schneider

The remains of Mayannah Schneider, a 2 ½-3 ½ year old female were found along with those of 27 other persons, including her mother, Judy Schneider (MC 51), in the concrete bunker. Her remains are composed of the separately recovered body parts labeled MC 70 and MC 51A.

MC 70: Advanced decomposition is present.

There is global charring.

The respiratory tissues are decomposed to the extent that soot determination is not possible. No assessment of CO saturation was performed on this portion of the remains.

MC 51A: Only the skull and mandible are present. Some charred scalp is present. No DNA analysis was performed.

There is heat damage/fracture of the right occipitoparietal area.

There are no anatomic structures of the airway available to assess for soot deposition. The blood CO saturation was reported as 37.5%.

Conclusion: The elevated blood CO saturation is consistent with smoke inhalation. Confirmation of smoke inhalation by airway soot deposition is not possible due decomposition. Overall, no injuries unrelated to fire are observed. On balance, a lethal gunshot wound, blunt trauma or sharp trauma can be reasonably excluded.

Cause of Death: Smoke inhalation, thermal burns.

MC 71--Michelle Thibodeau (nee Jones)

Ms. Thibodeau, an 18 year old White woman (DOB 7/4/74), was found along with 27 other persons, including her daughters (MC 63, 72, 73), in the concrete bunker.

There is advanced decomposition.

There is evidence of smoke inhalation. Small deposits of soot are present in the large and small airways. The airways also contain a large amount of frothy hemorrhagic fluid. The CO saturation of the liver is reported as 8.75%.

There is focal charring.

No evidence of a gunshot wound is present.

The ethanol found in the liver (0.05 gm%) and bile (0.07 gm%) is consistent with decomposition. The cyanide found in the bile (0.06 mcg/ml) is attributable to decomposition and/or smoke inhalation.

Conclusion: The presence of soot in the lower portions of the airway indicates smoke inhalation. No lethal injuries unrelated to the fire are identified or reasonably suspected.

Cause of Death: Smoke inhalation, thermal burns.

MC 72--Serenity Jones

Serenity Jones is a 4-5 year old White female who was found with 27 other persons, including her mother, Michelle Thibodeau (MC71) and sisters (MC 63, 73), in the concrete bunker.

There is marked decomposition.

Decomposition precludes adequate assessment of the airways for soot. The liver CO saturation is reported as 50%. It is not possible to definitively establish if the reported CO saturation is a reflection of antemortem CO content or if it is a false positive laboratory value related to the effects of decomposition (see toxicology section discussion regarding CO interpretation).

The ethanol measured in the liver (0.01 gm%) is consistent with postmortem production.

There is focal charring.

No firearm injuries are identified.

Conclusion: Although there is not much information available upon which to base an opinion about the cause of death, the lack of demonstrable other injuries makes it likely that death was related to the fire (smoke inhalation and thermal burns).

Cause of Death: Smoke inhalation, thermal burns.

MC 73--Jones Twin

This 1 ½ year old White female was recovered along with the remains of 27 other persons, including several children, in the concrete bunker. Her mother, Michelle Thibodeau (MC 71) and sisters (MC 63, 72), were also found in this area.

Decomposition is advanced.

Decomposition precludes adequate evaluation of the airway for soot. The liver CO saturation is reported as 52.5%. It cannot be definitely established if the recorded CO saturation accurately reflects the antemortem CO content or if it is a false positive laboratory value related to the effects of decomposition.

There is charring of the head and portions of the torso.

No evidence of any other type of injury is noted. The head and body cavities are intact.

The ethanol measured in the liver (0.03 gm%) is consistent with postmortem production.

Conclusion: Although definitive evidence of smoke inhalation is lacking, overall, I think death was most likely related to the fire. No lethal injuries unrelated to the fire are identified or reasonably suspected.

Cause of Death: Smoke inhalation, thermal burns.

MC 74--Melissa Morrison

Melissa Morrison, a 6 year old Black female (DOB 7/9/86), was found along with 27 other persons, including her mother, Rosemary Morrison (MC 75), in the concrete bunker.

The remains primarily consist of the lower extremities, portions of the upper extremities, pelvis and right scapula. There is focal charring.

The possibility of smoke inhalation cannot be assessed. Gunshot injury to the head and chest/abdomen cannot be excluded.

The repatriated remains were re-examined in the UK. The UK examination indicates they were unable to evaluate the cause of death due to the amount and condition of the tissue available for evaluation.

Conclusion: Insufficient information is present to determine the cause of death. Major vital structures are not available for evaluation. The only reasonable cause of death is either at the hands of another person or due to the effects of the fire.

Cause of Death: Undetermined.

MC 75--Rosemary Morrison

Ms. Morrison, a 30 year old Black woman (DOB 10/1/63), was found along with 27 other persons, including her daughter (MC 74), in the concrete bunker. A Seiko watch on the left wrist had stopped at 4:00 o'clock.

There is advanced decomposition.

Decomposition precludes adequate evaluation of the airways for soot. Decomposition fluid from the left chest cavity had a CO saturation reported as 50% (see toxicology section discussion regarding CO interpretation).

The upper torso is charred.

The head is absent. The anthropology report indicates the head had separated at C7 with part of C6 being present and that the separation may be related to avulsion of the head.

A gunshot wound or other injury involving the head cannot be excluded.

The ethanol found in the chest fluid (0.01 gm%) can be attributed to decomposition. The cyanide measured in the chest fluid (0.07 mcg/ml) is consistent with decomposition and/or smoke inhalation.

The repatriated remains were examined in the UK. The first examination of the remains thought to be those of Rosemary Morrison were actually those of MC 61 (Martin child). The remains of Rosemary Morrison were subsequently obtained and examined. The amount and condition of the tissue available for evaluation precluded evaluating the cause of death and confirming smoke inhalation. The report does conclude that the presence of CO (TCMEO toxicology) indicates she was alive during the fire and that smoke/CO inhalation was the sole or a significant factor in her death. A head injury could not be excluded due to the lack of adequate tissues for evaluation. Doubt about death due to suffocation was expressed.

The interpretation of CO measured in decomposing material in the absence of airway soot as an indicator of smoke inhalation must be made with great caution because of potential interference by decomposition products with the analytic process (see toxicology discussion). The UK examiners were apparently unaware of the reported presence of CO in two bodies recovered from graves that had been buried prior to the fire and had no apparent exposure to any other source of significant CO.

Conclusion: Although the chest fluid CO may be due to smoke inhalation, there is insufficient information to definitely establish the presence of smoke inhalation. A lethal head injury cannot be excluded. On balance, I do not think there is enough information to determine the cause of death.

Cause of Death: Undetermined.

Manner of Death: Undetermined (Homicide or Suicide).

Concrete bunker

Area Closest to Cooler

MC 59--Unknown

This unidentified 14-19 year old White female was recovered along with 27 other persons, including several children, in the concrete bunker. An Armitron watch had stopped on 4/20/93 at 6:00 o'clock.

There is marked decomposition. The body is relatively intact above the inferior pelvic area. Some of the facial structures and a portion of the lower left calvarium are absent. The head and torso are disarticulated.

There is a skull fracture involving the right frontal and both parietal bones. There is a 5 mm round non-beveled perforation in the right frontal area. A partially beveled perforation with a small radiating fracture is present in the parietal area. The fracture pattern indicates the right frontal defect was present prior to the parietal defect. No brain tissue remains. There are fractures on the first maxillary molars. The nature of the blunt force injury is not apparent but appears consistent with falling debris. No photographs depicting the skull defects in sufficient detail are available for my independent assessment. The perforating defects are probably postmortem and due to exploding ("cooked off") unchambered ammunition.

The "evidence collected" list includes "blood clot and soft tissue" from the chest cavity. Neither the autopsy findings list nor the autopsy description section indicates the presence of any localized accumulations of blood. The chest, abdominal and pelvic organs are described as being "reduced to mushy pasty foul smelling partially liquified tissue" as the result of decomposition.

Smoke inhalation cannot be assessed. The neck organs and the lungs are absent. No toxicology data is available.

There is no evidence of an antemortem gunshot wound.

I have been advised by the OSC that a non-OSC expert has stated that the posture demonstrated by the body of MC-59 after it was recovered and removed from the bunker indicates the child had seizures before death that were an indication of cyanide toxicity.

I disagree with this expert's opinion for a variety of reasons. In general, postmortem posture cannot be used as a direct indicator of antemortem posture or activity, including seizures. This is especially true when the body has been removed from the environment in which it was found. Information about the position of the body at the time of collapse can be obtained by examining the body before it is removed from its resting place and by correlating marks on the

body with the causative agents at the scene. Information pertaining to the position of the body after death obtained during examination of the body after it has been removed from its resting place is more limited. Alterations in the posture of the body caused during recovery and transport, such as easily occur when manipulating a body that is flaccid due to decomposition, further complicate any attempt to determine antemortem positioning.

There is no postmortem posture that specifically indicates the decedent experienced seizure activity prior to death. The muscles of the body initially become flaccid when death occurs and body positioning is dictated by gravity and environmental constraints upon passive movement of the body. The postmortem position or posture of the body may have little, or no, similarity to the position or posture of the body prior to death. During the hours after death, the muscles stiffen (rigor mortis) and the postmortem posture may be maintained until flaccidity of the body returns as decomposition progresses.

MC-59 was markedly decomposed, buried in debris in the bunker and was manipulated during the recovery process. Any attempt to correlate the postmortem posture of the body as it appeared after she had been removed from the bunker with her antemortem activity is futile and not scientifically sound.

Furthermore, there is nothing unique about the appearance of seizures induced by cyanide when compared to seizures having other causes such as those that occur as a consequence of smoke inhalation, head injury or as non-specific activity during the process of dying. Determining the cause of a seizure involves correlating pertinent information from the decedent's history, the circumstances surrounding death, the death scene, the examination of the body and the results of laboratory studies. There is no toxicologic data supporting the presence of cyanide toxicity in MC-59. Other potential causes of terminal seizure activity, such as smoke inhalation, are not able to be excluded. However, there is currently no evidence suggesting MC-59 experienced seizures prior to her death.

Conclusion: The skull fractures are consistent with blunt head injury. No other definite antemortem lethal injuries are identified. The presence of smoke inhalation cannot be assessed. If present, smoke inhalation may have contributed to death.

Cause of Death: Blunt Head Injury.

MC 62-Chanel Andrade

Chanel Andrade, a 1 year old White female (DOB 2/6/92), was found along with 27 other persons, including several children, in the concrete bunker. Her mother, Katherine Andrade (MC 30), was found on the surface in the concrete bunker.

There is advanced decomposition. The remains consist of decomposing soft tissue mixed with skull bones, vertebrae, ribs, pelvic bones and bones from the extremities. The viscera consist of amorphous decomposing tissue. Straight brown scalp hair is present.

The possibility of smoke inhalation cannot be assessed. No airways are available to assess for soot deposition. No toxicologic data is available.

There is a compression fracture of the anterior left ninth rib.

There is a 9 x 7 mm defect in the right temporal bone which has a small area of beveling of the internal table of the skull bone. Numerous radiodense particles surround the defect. The nature of the wound is not ascertainable based on the available written description. Photographs of the wound are not available. The description of the wound is not particularly suggestive of an antemortem gunshot. A 12 gauge shotgun wad and 1 pellet accompany the body. The skull defect is not particularly suggestive of a shotgun wound. This may be a postmortem defect caused by exploding unchambered ammunition.

Conclusion: Insufficient information is present to determine the cause of death. The only reasonable cause of death is either at the hands of another person or due to the effects of the fire.

Cause of Death: Undetermined.

MC 64-Pages Gent

Pages Gent, a 1 year old White female, was found along with 27 other persons, including several other children, in the concrete bunker. Her mother, Nicole Little (MC 47), was found on the surface in the concrete bunker.

This body was co-mingled. The body was apparently received in a bag which also contained a blanket that was badly stained red (the anthropology report indicates the red material was probably blood) having at least one perforation that might be a bullet or shrapnel hole. The margin of the hole is partially burned. It is not clear whose blood is on the blanket (see MC 65). No mention of any other burning of the blanket is noted. The left posterior flank area of a t-shirt had a 20 x 8 mm defect.

Decomposition with disarticulation is present. The body is focally charred. The occipital and left temporal bones are absent. The tissues of the respiratory tract are absent. The liver CO saturation is reported as 56%. It cannot be established if the reported CO saturation accurately reflects the antemortem CO content or if it is a false positive laboratory value related to the effects of decomposition (see toxicology section discussion regarding CO interpretation).

A piece of scalp with brown hair and blood is present. The frontal bones have blood on the periosteal surface. Blood is also present in the right temporalis area and in the maxillary sinuses. The anthropology report indicates a large area of hemorrhage (22 x 7 cm) in the left chest cavity and adherent to the lateral right parietal pleura. No bone damage is identified.

Ammunition primers are present in the neck, deep in the maxilla and in the soft tissues of the right arm, thorax and distal radius/ulna. Laboratory examination of a fragment of metal associated with these remains indicates it originated from "cooked off" ammunition.

A gunshot wound to the chest/abdomen cannot be excluded. Blunt trauma to the chest/abdomen and head also cannot be excluded.

The liver ethanol (0.02 gm%) is consistent with decomposition.

Conclusion: Insufficient information is present to determine the cause of death. Smoke inhalation cannot be adequately assessed and an antemortem lethal injury unrelated to the fire cannot be excluded. The only reasonable cause of death is at the hands of another person or due to the effects of the fire. The body was struck after death by fragments of heat-exploded ammunition.

Cause of Death: Undetermined.

MC 65-Unknown

This unidentified 1 ½-2 ½ year old female was found amount 27 other persons, including several children, in the concrete bunker.

There is advanced decomposition. Focal charring is present. This body was co-mingled. The body was apparently received in a bag which also contained a blanket that was badly stained red (the anthropology report indicates the red material was probably blood) having at least one perforation that might be a bullet or shrapnel hole. The margin of the hole is partially burned. No mention of any other burning of the blanket is noted. The source of the blood is not known (see MC 64).

The respiratory organs are absent or not recognizable due to decomposition. The blood CO saturation is reported as 73%. It cannot be definitively established if the reported CO saturation accurately reflects the antemortem CO content or if it is a false positive laboratory value due to the effects of decomposition (see toxicology section discussion regarding CO interpretation).

There are fractures of the right clavicle, right first rib, lateral right second rib and lateral right sixth rib. The left mandible is fractured. Most of the bones of the cranial vault are fractured. There is an area of missing bone in the midline of the posterior 1/3 of the sagittal suture which along the left side suggests that a roughly circular perforation might have been present. This area demonstrates internal beveling with associated radiating fractures. Clotted red blood is seen within the decomposing brain tissue. An antemortem gunshot wound cannot be excluded.

There are five transverse processes of thoracic vertebrae fractured at the midline. A fragment of metal is embedded within the fractured surface. I do not see any record that this piece of metal was recovered and submitted for laboratory examination.

Projectile injuries which appear to be related to exploding non-chambered ammunition are also present.

The cyanide detected in the blood (0.27 mcg/ml) is consistent with decomposition and/or smoke inhalation.

Conclusion: Insufficient information exists to determine the cause of death. Smoke inhalation cannot be adequately evaluated. An antemortem gunshot wound cannot be excluded. The only reasonable cause of death is either at the hands of another person or due to the effects of the fire. The body was struck after death by heat-exploded ammunition fragments.

Cause of Death: Undetermined.

MC 66-Lorraine Sylvia

Ms. Sylvia, a 40 year old White woman (DOB 5/23/52), was found along with 27 other persons, including her daughters (MC 67-4, 67-6), in the concrete bunker.

There is advanced decomposition. There is some charring of the body. Only the upper area of the torso is present.

There is a round defect in the left bra cup and the adjacent portion of the t-shirt. No corresponding defect is seen in the coat but the burn pattern suggests the coat was open. There are at least six perforations (4-11 mm) of the left scapula. Five of the scapula defects on the anterior surface demonstrate anterior displacement of bone fragments. There are defects involving multiple ribs. Some of the rib defects are circular. A radiograph demonstrates radiodense particles within a fractured burned segment of the medial portion of the left clavicle. No range of fire determination can be made. At least 150 ml bloody material is present in the left chest. These wounds entry sites were on the back and were received at the hands of another person.

A gunshot wound of the head cannot be excluded.

There is an 8 mm circular defect in the proximal left humerus.

No assessment for smoke inhalation is possible. The respiratory structures are absent. No toxicologic data are available.

A consultant forensic pathologist (not retained by OSC) who reviewed this death indicates that this woman was shot by someone else or the wounds were caused by "exploding ordinance rounds." I do not agree that unchambered heat-exploded ammunition (cooked off) would create these injuries. I would not expect cooked off bullets to perforate the entire thickness of the chest, including passing through the shoulder blade, and clothing covering the front of the chest (bra).

Conclusion: There are multiple gunshot wounds that entered through the back. The bloody material localized in the left chest indicates she was alive when she was shot. The features of the wounds indicate they were caused by low velocity projectiles. I would expect significantly more damage to the shoulder blade if the projectiles were high velocity. These wounds were sustained at the hands of another person. No assessment of smoke inhalation is present. Some small defects in other portions of the body may have been caused by being struck after death by heat-exploded ammunition fragments.

Cause of Death: Gunshot Wounds of Chest.

MC 67-1--Star Howell

Star Howell, a 5-6 year old White female, was found along with 27 other persons, including her mother, Rachel Howell (MC 67-3) and siblings (MC 67-2, 67-5/69), in the concrete bunker.

There is advanced decomposition. The body is fragmented. Charring is accompanied by heat fractures. Most of the skull is absent except for a fragment of left parietal bone and possibly a fragment of temporal bone.

The structures of the respiratory tract are not present. The liver CO saturation is reported as 43.75%. It cannot be established if the reported CO saturation accurately reflects the antemortem CO content or if it is a false positive laboratory value related to the effects of decomposition (see toxicology section discussion regarding CO interpretation).

A gunshot wound or significant blunt trauma to the head cannot be excluded. There is a non-heat related fracture of the inferior left parietal bone.

A shrapnel defect is present in the left humerus. This is consistent with a postmortem injury related to heat-induced explosion of non-chambered ammunition.

Conclusion: There is insufficient information to determine the cause of death. The presence of smoke inhalation cannot be definitely established. A lethal antemortem injury unrelated to the fire cannot be excluded. The only reasonable cause of death is either at the hands of another person or due to the effects of the fire.

Cause of Death: Undetermined.

MC 67-2--Cyrus Howell

Cyrus Howell, an 8 year old White male (DOB 3/22/85), was recovered along with 27 other persons, including his mother, Rachel Howell (MC 67-3) and siblings (MC 67-1, 67-5/69), from the concrete bunker.

Decomposition and extensive charring are present. The head, right chest wall and chest/abdominal organs are absent. No assessment for smoke inhalation is possible due to the lack of intact respiratory structures and the lack of toxicologic data.

Injuries, including firearm injuries, cannot be excluded.

Conclusion: There is insufficient information to determine the cause of death. Smoke inhalation cannot be adequately assessed. An antemortem lethal injury unrelated to the fire cannot be excluded. The only reasonable cause of death is either at the hands of another person or due to the effects of the fire.

Cause of Death: Undetermined.

MC 67-3--Rachel Howell

This 23 year old White woman (DOB 5/2/69) was recovered along with 27 other persons, including her children (MC 67-1, 67-2, 67-5/69), from the concrete bunker.

There is extensive charring. The calvarium and portions of the base of the skull missing. No assessment for smoke inhalation is possible. The proximal trachea is decomposed. The distal trachea and lungs are absent. No toxicologic data is available.

There are non-heat fractures of the right 2-3 ribs. There is a slight defect of the right first rib. Clotted blood (100-150 ml) is present on the abdominal side of the right diaphragm. The anthropology report indicates an area of clotted blood in the left middle rib area suggestive of trauma. The protocol indicates a finding of left leg crush injuries, but a detailed description of the left leg is not present. There are fractures of the midportion of the right radius and ulna.

A gunshot wound of the head cannot be excluded.

Conclusion: Smoke inhalation cannot be adequately assessed. There is evidence of some blunt trauma to the chest area which may have played a role in the death. A gunshot wound to the head cannot be excluded. Overall, I believe the available information is insufficient to reliably establish the cause of death.

Cause of Death: Undetermined.

Manner of Death: Undetermined (Homicide or Suicide).

MC 67-4--Hollywood Sylvia

Hollywood Sylvia, a 1-2 year old White female, was found along with 27 other persons, including her mother, Lorraine Sylvia (MC 66) and sister (MC 67-6), in the concrete bunker. The front of a garment has extensive blood staining.

Advanced decomposition and focal charring are present.

The respiratory structures are not in suitable condition to assess for soot deposition. The liver CO saturation is reported as 33%. It cannot be established if the reported CO saturation reflects antemortem CO content or if it is a false positive laboratory value related to the effects of decomposition (see toxicology section discussion regarding CO interpretation).

A gunshot wound involving the head or chest/abdomen cannot be excluded. Blunt force injuries also cannot be excluded. There appears to be a large blood clot matted into decomposing tissue which appears to be lung. No injuries to bone are observed.

Conclusion: There is insufficient information to establish the cause of death. Smoke inhalation cannot be established and the presence of a lethal antemortem injury unrelated to the fire cannot be excluded. The only reasonable cause of death is either at the hands of another person or due to the effects of the fire.

Cause of Death: Undetermined.

MC 67-5/MC 69--Bobbie Koresh (DOB 10/14/91)

Bobbie Koresh, a 1 year old White female (DOB 10/14/91), was found along with 27 other persons, including her mother (MC 67-3) and siblings (MC 67-1, 67-2), in the concrete bunker.

Advanced decomposition is present. There is focal charring at the vertex of the skull and the right chest. The remains are fragmented.

Some soot is described in the right lung tissue. The left lung, larynx and trachea are absent. The blood CO saturation is reported as 50%.

There are several relatively superficial compression defects involving the bones of the skull and extremities. No wound tracks or focal areas of hemorrhage are seen within the decomposing brain tissue. Taken in their entirety, these are not particularly suggestive of antemortem firearm injuries. They are most likely postmortem defects related to heat-induced explosions of unchambered ammunition.

The autopsy protocol indicates "simply an impression" of an ill-defined area that may be clotted blood against a background of marked decomposing tissue. The left lung is absent. No damage to the heart is evident. No definite evidence of an antemortem mechanical injury to this area is present. I think this discoloration is probably related to decomposition.

The blood ethanol (0.06 gm%) is consistent with postmortem production.

Conclusion: The presence of soot in the lower portion of the airway indicates smoke inhalation. The elevated CO saturation in the blood is consistent with smoke inhalation. No lethal injuries unrelated to the fire are identified or reasonably suspected. The body was struck after death by fragments most likely from heat-exploded ammunition.

Cause of Death: Smoke inhalation, thermal burns.

MC 67-6--Rachel Sylvia

Rachel Sylvia, a 13 year old White female (DOB 6/6/79), was found along with 27 other persons, including her mother, Lorraine Sylvia (MC 66) and sister (MC 67-4), in the concrete bunker.

There is severe charring of the partial remains. The upper torso and skull are absent. Isolated rib fragments are present. No assessment for smoke inhalation can be made. The respiratory tract structures are absent. No toxicologic data is available. Gunshot wounds of the head or chest/abdomen cannot be excluded.

Conclusion: Insufficient information is present to determine the cause of death. Smoke inhalation cannot be adequately assessed. Antemortem injuries unrelated to the fire cannot be excluded.

Cause of Death: Undetermined.

Manner of Death: Undetermined (Homicide or Suicide).

MC 67-7 / MC 67-8--Unknown

This unidentified child (circa 13 month old) was found along with 27 other persons in the

concrete bunker. The separately identified remains 67-7 and 67-8 most likely originated from the

same person.

MC 67-7: There is global charring of the partial remains which consist of the pelvis, legs,

feet and left ulna. No DNA analysis was performed.

MC 67-8: The remains consist of a portion of the frontal bone, right maxilla, ethmoid and

vomer.

There is a gunshot entry site in the midportion of the left frontal bone. The 15 mm circular perforation has internal beveling and is associated with radiating fractures. A 6 x 3 mm

perforation of the left greater wing of the sphenoid is present. The range of fire cannot be

determined.

There also appears to be a 9 mm circular defect with slight internal beveling involving the

right border of the frontal bone near the midline. Only the left ½ of the this defect is present.

Conclusion: There is at least one, and possibly two, gunshot wounds of the head. Smoke

inhalation cannot be adequately assessed. The gunshots were sustained at the hands of another

person.

Cause of Death: Gunshot Wound of Head.

Concrete tornado shelter

Four adults were recovered from a grave in this area. Each of these persons died of gunshot wounds on February 28, 1993.

MC 77–Winston Blake

Mr. Blake, a 28 year old Black man (DOB 1/31/65), was found in a grave along with three other persons in the concrete tornado shelter. Each of these persons died of gunshots on February 28, 1993.

There is moderate-marked decomposition. The body is clothed and intact.

There is a gunshot wound of the head that entered through the right postauricular area (behind the right ear). The range of fire is very close/near-contact. No soot or powder stipple is seen on the surface surrounding the gunshot defect except for some possible slight soot deposition along the immediate edge. However, there is loss of epidermis due to decomposition. Soot/gunpowder is present in the dermis, in the subcutaneous tissue and on the underlying bone at the entry site. Laboratory testing confirmed the presence of gunpowder in the wound. Dark material in the petrous portion of the right temporal bone contained lead and antimony, but the amount of barium detected was below the laboratory's cutoff for a "positive" result. The entry site measured 5/8 inch and the scalp was extensively torn (avulsed) from the underlying skull. It is possible, although not necessary, that some reduction in damage is related to dissipation of gas in the atmosphere through the use of a suppressor. The wound is not consistent with the presence of any substantive intermediate target. The bullet passed leftward through the skull to penetrate the cranial cavity causing extensive fragmentation of the skull and damaging the brain. The fragmented bullet was recovered from the cranial cavity. The bullet was identified as a high velocity rifle bullet, specifically .223 caliber. The wound could have been received at the hands of another person. It is possible that the wound was self-inflicted. However, the location of the wound is somewhat unusual for a self-inflicted rifle wound.

No other injuries are evident.

The ethanol (0.09 gm%) and cyanide (0.03 mcg/ml) found in the blood are consistent with postmortem production. The blood CO saturation was reported as negative.

MC 77's repatriated remains were re-examined in the UK. The UK examination report indicates the presence of a right retroauricular wound consistent with a ballistic injury and having features strongly suggestive of a low weight high velocity bullet. The scalp defect was reported to measure 5 x 4 cm. The condition of the remains was felt to preclude a determination of the cause of death. The firearms expert said that the US file indicates the decedent sustained a high velocity gunshot injury during the initial gun battle. The firearms expert indicates the presence of a gunshot to the left side of the head and opines that the wound probably was caused by a high velocity relatively low weight bullet destabilized when it passed through a light intermediate target such as "material reported to have been used in the construction of the building walls."

The opinion of the UK firearms expert as to the destabilization of the bullet by the presence of an intermediate target such as the building wall is contradicted by the demonstration (visual and chemical) of gunpowder in the wound track. As noted above, the range of this gunshot is very close-near contact and enters the head through the right side.

A forensic pathologist retained during litigation about this person's death (not retained by OSC) indicates that the failure of the bullet to exit the head is inconsistent with the wound being a contact wound since it is his "experience that rifle injuries fired at close range do not remain in the body." He also points to the lack of secondary tearing of the scalp. While it is true that most high velocity bullets perforate the body, it is well recognized that some high velocity bullets, notably .223 bullets, do not always perforate and may remain in the body, as was the case with this decedent. Secondary tearing of scalp is the expected finding in contact wounds of the head using this type of gun and was not present in Mr. Winston's scalp. A number of factors may account for the absence of the usual extensive scalp tearing. The muzzle may have been close to the surface, but not in firm contact with the head, thus allowing the muzzle gasses to dissipate to some extent in the atmosphere. Any soot deposited on the skin surface would have been lost as the superficial layer of the skin (epidermis) was sloughed during decomposition. The ammunition may have been faulty. The use of a suppressor attached to the muzzle would also allow some dissipation of gas even if the suppressor was in contact with the skin surface when the gun was discharged. Some of the extensive scalp avulsion noted in the autopsy report may have been due to gas dissipation along the plane between the scalp and skull. Expansion of the gas through this area may also have played a role in preventing extensive scalp tearing. In addition, some individuals having this type of injury inexplicably lack the usual extensive tearing.

The consultant forensic pathologist's report also indicates that some other person speculated that the dark sooty material in the wound track may be remnants of tar paper from the roof of the structure. This contention is also refuted by the currently available information. A bullet, especially a high velocity small bullet such a .223, would not carry and deposit in this fashion any material from an intermediate target, such as tar paper, through which it passed. In addition, the presence of grossly apparent gunpowder within the wound track is inconsistent with this contention.

David Thibodeau's book indicates Mr. Blake was sitting and eating breakfast when a bullet "crashed through the water tanks outside his window..." and hit him under the right ear. The postmortem examination indicates Mr. Blake's gunshot could not have been sustained in this manner. Mr. Blake's gunshot wound was caused by a gun which was being held very close to or nearly in contact with his head when it was discharged and could not have been caused by a gun fired outside of the complex. The wound is not consistent with the presence of any substantial intermediate target as Mr. Thibodeau claims. The fragmented bullet remained in the head and no defects which could be construed as exit sites were present.

Mr. Thibodeau's contends that a doctor with the Manchester, England police, who later examined the body, "found that Winston's injury could have been covered up by a subsequent point-blank shot to make it seem as if we'd [Davidians] killed him." The postmortem findings of a single entry site, no exit site and a single fragmented bullet in the body preclude this possibility. The UK pathologist who conducted the second postmortem examination was not able to examine the actual entry defect since the bone and some of the skin and subcutaneous tissue were removed and retained during the initial autopsy. Dr. Krouse, the TCMEO pathologist who examined Mr. Blake, informed the OSC that the skin and soft tissues were also very fragile due to the decomposition. These tissues likely underwent further disruption due to handling of the body subsequent to the first autopsy.

Cause of Death: Gunshot Wound of Head

Manner of Death: Undetermined (Homicide or Suicide).

MC 78--Jaydean Wendel

Ms. Wendel, a 34 year old White woman (DOB 12/10/58), was recovered from the concrete tornado shelter grave site. Her body was recovered along with the bodies of three other Davidians who also died of gunshot wounds on February 28, 1993.

There is moderate-marked decomposition. The body is intact and clothed.

There is a low velocity projectile gunshot wound of the head. The entry site is in the right parietal scalp. The wound lacks any evidence of soot deposition or powder stippling. The wound is consistent with a distant wound (muzzle to target distance in excess of approximately 2-3 feet, depending on the type of gunpowder) or a wound involving the bullet passing through an intermediate target. The wound track is leftward, downward and slightly backward. The bullet passed through the scalp, skull (right parietal bone), brain to perforate the skull (left parietal bone). Bullet fragments were recovered and identified as a Hydra-Shok bullet. This wound was likely inflicted by another person.

The ethanol measured in the liver (0.03 gm%) is consistent with decomposition. The toxicology report also indicates the presence of CO in the liver (43% saturation). There is no evidence of soot deposition in the airway to support a diagnosis of smoke inhalation. In addition, there is no information suggesting this Branch Davidian decedent was exposed to any other source of CO that would result in such a high CO saturation. In view of the lack of apparent sources of CO that Ms. Wendel could reasonably have been exposed to, I believe that the reported CO saturation of 43% represents an analysis-related false positive laboratory test result that arose because of decomposition (see toxicology section discussion regarding CO interpretation).

Cause of Death: Gunshot Wound of Head.

MC 79--Peter Hipsman

Mr. Hipsman, a 28 year old White man (DOB 3/15/65), was recovered along with three other persons from the concrete tornado shelter grave. Each of these persons died of gunshot wounds sustained on February 28, 1993.

There is moderate decomposition. The body is clothed and intact. The clothing includes a hooded sweatshirt.

There are four gunshot wounds caused by low velocity projectiles:

There is a gunshot entry site on the anterolateral lower left chest. The bullet passed rightward through the left seventh rib, left diaphragm, stomach, liver, right diaphragm, right seventh rib to come to rest in the lower right axilla. The recovered bullet was a semi-jacketed 9 mm HP. It was noted to have a fragment of wood imbedded in the nose. The bullet passed through a wood intermediate target prior to striking the decedent. The bullet also apparently passed through the clothing prior to striking the decedent. No powder residue was seen on the skin or the clothing at this site. Dr. Krouse, the TCMEO autopsy pathologist, informed the OSC that the wound track through the liver was at least a couple of centimeters in diameter, maybe as wide as 3-5 cm and that it did not appear surgically repairable. A small amount of blood was present in the chest and abdominal cavities. This wound would not necessarily have been immediately lethal or incapacitating. This wound would definitely be fatal if medical care was withheld and, based on Dr. Krouse's description of the liver damage, would probably be lethal even if medical care was available.

A bullet entered the posterolateral left arm. It traveled forward through the subcutaneous soft tissue to exit the anterolateral aspect of the left arm. No gunpowder was identified on the skin. However, the bullet apparently passed through clothing prior to striking the skin. There is no physiologic reason for this wound to incapacitate the person.

There is a gunshot wound of the head that has the entry site on the back of the neck near the base of the skull. No soot or gunpowder stippling were seen on the skin around the entry site. Soot was identified in the subcutaneous soft tissue. Gunpowder from the wound track was demonstrated microscopically and by laboratory analysis. This wound was received with the muzzle of the gun in contact with the body's surface (contact wound). The wound track is upward and forward and somewhat leftward. Damage to the head/neck from the two gunshots involving this area has obscured the course of this bullet. There does appear to be an internally beveled defect with radiating linear fractures involving the left occipital bone. No bullet related to this wound was found within the calvarium. A fully jacketed 9 mm bullet was recovered from the upper midback of the clothing.

There is a gunshot entry in the posterior right parietal scalp. Soot was present around the margin of the wound. Soot was also identified on the surface of the underlying bone. Numerous gunpowder particles were identified microscopically and chemically. This wound is a near-contact/loose contact wound. The wound track is downward through the skull and brain to exit the skull through the right posterior fossa. A semijacketed HP 9 mm Winchester Silvertip bullet was recovered from the right neck below the posterior fossa.

The intersecting fracture lines created by the bullets striking the skull (neck and scalp entries) indicate that the parietal gunshot wound was sustained prior to the neck entry wound.

The three bullets belonged to the .38 caliber family. Two of the bullets (chest and "loose") had copper jackets and one bullet (suboccipital head) had an aluminum jacket. The Tarrant County firearms laboratory indicates "intercomparison of the three bullets listed above fails to reveal any correspondence between the three." The FBI laboratory report indicates that the aluminum jacketed bullet and one of the other bullets were discharged through the same gunbarrel.

None of the gunshot wounds appear to have been self-inflicted.

Kathryn Schroeder's testimony indicates that she was told by Neil Vaega that Peter Hipsman had been shot in the head and abdomen while on the top floor of the tower but was still alive when he was "finished off" by Neil Vaega. Neil Vaega reportedly told her it required 2 shots to kill Mr. Hipsman. The postmortem examination of Mr. Hipsman supports a portion of this account. Mr. Hipsman did have two contact/near-contact gunshot wounds in locations consistent with shots incurred with the intent to "finish off" someone. Mr. Hipsman also had a gunshot that entered the lower left chest that would be consistent with a lay person referring to it as a gunshot of the abdomen. Contrary to the account described in the testimony, Mr. Hipsman did not have any gunshot wounds of the head except for the one previously noted. He had a relatively minor gunshot wound of the left arm that was not mentioned in the testimony.

David Thibodeau's book indicates Mr. Hipsman was in a room at the top of the four-story residential tower when helicopter gunmen fired and Mr. Hipsman was struck in the side by a bullet which passed through him. The book indicates Mr. Hipsman was shot twice in the head to be put of his "misery" after other Davidians saw that "Peter's wound was fatal." The postmortem findings are consistent with the book's description of Mr. Hipsman being killed by two gunshot wounds of the head delivered by another Davidian. The bullet that struck Mr. Hipsman in the "side" (chest) remained in the body and was not matched to any known US government agent's gun. The book also claims that the gunshot that struck Mr. Hipsman in the side came "from above" through the ceiling. The trajectory of the shot entering the side (basically level from left to right) would only be consistent with this scenario if Mr. Hipsman was markedly bent over sideways at the waist or lying horizontal when he received this wound.

The ethanol detected in the blood (0.13 gm%) is consistent with postmortem production. No CO was detected in the blood.

Cause of Death: Gunshot Wounds of Head.

MC 80--Perry Jones

Mr. Jones, a 64 year old White man (DOB 1/20/29), was recovered along with three other persons from the grave in the concrete tornado shelter. Each of the individuals recovered from this site died of gunshot wounds on February 28, 1993.

There is moderate decomposition. The body is clothed and intact.

There is a gunshot wound of the head. The gunshot was sustained with the muzzle in the oral cavity when the gun was fired. The anterolateral right edge of the tongue is disrupted and has soot deposited on it. The wound track is backward, slightly upward and minimally rightward. The bullet passed through the palate/posterior nasopharynx, base of the skull, brainstem area, posterior fossa to lacerate the tentorium, occipital bone to exit the right occipital scalp. This gunshot could either be self-inflicted or could have been administered by another person. Although the vast majority of intra-oral gunshot wounds are self-inflicted there are occasional intra-oral gunshots that are sustained at the hands of another person. The wound features indicate it was caused by a low velocity projectile. A high velocity projectile would have caused more extensive damage.

No other injuries are identified. No significant natural diseases are found.

The ethanol in the liver (0.04%) is consistent with decomposition. The laboratory also reports the liver CO saturation as 52%. There is no indication of a CO source that would cause saturation to the extent reported by the laboratory. The reported elevated CO saturation is a false positive laboratory value related to the effects of decomposition (see toxicology section discussion regarding CO interpretation).

Kathryn Schroeder's testimony indicates Neil Vaega twice asked David Koresh if he (Vaega) could "finish off" Perry Jones. Neil Vaega reportedly then returned and told Koresh that it had been done. This testimony appears to contradict the postmortem findings, in that, the autopsy failed to reveal any wound or other physical condition that would prompt a need or desire for someone to "finish him [Mr. Jones] off." Only one wound was present and was received with the muzzle of the gun in the oral cavity when it was discharged. This wound is very typical of a self-inflicted injury, but certainly can result from the actions of some other person.

In his book, David Thibodeau indicates that he doesn't know if Mr. Jones "had died from his wounds, or if he'd killed himself, or if he'd gotten one of the guys to put him out of his suffering. Kathy Schroeder later claimed that Neal Vaega killed Perry as an act of mercy..." Mr. Thibodeau acknowledges that the autopsy demonstrated a single bullet wound fired "point-blank into his mouth." However, Mr. Thibodeau indicates all "those autopsies" were suspect. He indicates the bodies were stored in a faulty cooler at the medical examiner's office and partially decomposed prior to the autopsy. With regard to the faulty cooler, the OSC has advised me that

any refrigeration defect in the storage of the bodies was for a short period of time and occurred after the autopsies were already completed.

As noted above, the only physical injury that was demonstrated in this otherwise intact body was the intraoral gunshot. The contention that the body decomposed prior to autopsy due to faulty storage is also contrary to the postmortem findings. It is clear that the body already demonstrated moderate decomposition when it was exhumed. No significant additional decomposition occurred prior to the autopsy. In any event, the body was intact and other significant injuries would have been demonstrated regardless of any decomposition that was present.

Cause of Death: Gunshot Wound of Head.

Manner of Death: Undetermined (Homicide or Suicide).

Front of Complex Shallow Grave

One adult man was recovered from a grave in the front of the complex. He had been shot and killed on February 28, 1993.

MC 76--Peter Gent

Mr. Gent, a 24 year old White man (DOB 6/28/68), was recovered from a grave in the front of the complex where he was buried after being shot to death on February 28, 1993.

There is mild-moderate decomposition. The body is clothed and intact. The clothing has a defect consistent with a bullet hole.

There is a gunshot wound of the chest caused by a low velocity projectile that entered the upper anterior left chest. No soot or powder is seen on the clothing or the skin. The wound track is backward and slightly rightward passing through the anterior left second intercostal space damaging the aorta, pulmonary artery, heart, trachea and esophagus to terminate in the posterior mediastinum near the right lung hilum at the level of the sixth thoracic vertebra. The recovered bullet has copper jacketing and was identified as having been discharged through the particular barrel of an ATF agent's gun.

The ethanol found in the blood (0.14~gm%) and urine (0.05~gm%) is consistent with decomposition. No CO was detected in the blood.

Cause of Death: Gunshot Wound of Chest.

Ravine

One adult man was recovered on March 4, 1993 laying on the ground of a ravine where he was shot and killed on February 28, 1993.

MC-81 Michael Schroeder

Mr. Schroeder, a 29 year old White man (DOB 6/12/63), was recovered on March 4, 1993 from a ravine on the Perry Barn catch pen property. Mr. Schroeder had been shot and killed during a shootout with government agents on February 28, 1993.

There are six gunshot wounds that were caused by low velocity projectiles:

There is a gunshot entrance on the anterior right shoulder. No soot or powder stipple was seen on the skin. The wound track is backward, leftward and downward. The bullet passed through the lateral right third rib, right lung upper lobe, right middle lobe passing through the hilum and transecting a large bronchus and pulmonary artery segment, pericardium to penetrate the heart. There was mild subcutaneous emphysema of the anterior right chest wall, blood in the mediastinum, blood in the right chest cavity (1225 cc) and blood in the pericardium (155 cc). The bullet is a semi-jacketed HP.

There is a gunshot entrance through the lower anterior right flank. No soot or powder stipple is noted on the skin. The bullet traveled backward, downward and leftward. The wound track is via the lateral abdominal wall, right psoas muscle, right iliac artery/vein to graze the left innominate bone and come to rest in the medial left thigh. There was approximately 1000 cc blood in the pelvis. The bullet was noted to be consistent with a Hydra-shok bullet.

There is an entry site on the anterolateral left thigh. No soot or stipple is noted on the skin. The bullet traveled leftward and downward through the soft tissue to come to rest in the posterior distal left thigh. Hemorrhage is present within the soft tissues along the wound track. The bullet was noted to be consistent with a Hydra-shok bullet.

There is an entry site in the right temporal scalp. No soot or stipple is noted on the skin. The wound track is backward, leftward and slightly downward. The bullet passed through the scalp, skull creating an internally beveled defect on the lateral floor of the right middle fossa, brain (right temporal lobe, right occipital lobe, right cerebellum) to come to rest in the right occiput. Gunshot-related skull fractures are present. Hemorrhage is present along the wound track. A large caliber semi-jacketed fragmented bullet was recovered.

There is an entrance in the right supra-auricular area (upper front corner area of the ear). No soot or powder stipple are present on the skin. The bullet passed backward and slightly downward through the superior base of the ear to re-enter the right superior post-auricular area, right temporal bone (graze) to exit the right posterior auricular area. The gunshot fractured the right temporal bone and caused laceration of the right temporal lobe of the brain.

There is a graze wound of the anterolateral left chest. The wound track is vertical.

There is no evidence to indicate any of the gunshot wounds were contact, close or medium range.

The four bullets recovered from the body were 9 mm Hydra-Shock. Three of the bullets were matched to a particular barrel. The other bullet was not matched to or excluded from being discharged from any particular barrel.

Other injuries include a 1/4 inch superficial laceration with minimal hemorrhage on the ventral distal left thumb. There are some very superficial perimortem abrasions on the upper shin.

Conclusion: Overall, the wounds and scene photographs support the agents' accounts of the shooting incident that occurred on February 28, 1993. The evidence is not consistent with an "execution" of the Davidian involving the agents standing over him and shooting as he lay on the ground as depicted in the scene photographs.

Cause of Death: Gunshot Wounds of Head, Chest and Abdomen.

III-2B. Clive Doyle

Mr. Doyle arrived at the hospital circa 1 pm on 4/19/93. He had first and second degree thermal burns. His hands were burned circumferentially. The burning appears to be uniform and sharply demarcated at the wrists. One note in the medical records indicates a possibility that the thermal burns on the palmar surfaces of the hands were deeper than the other thermal burns. There was also some burning of the right ear. There were some first degree thermal burns scattered on the anterior/lateral neck and chin but these were not circumferential. No nasal soot or singed hair were identified. He was not short of breath at 1:42 pm and his oxygen saturation was 86%. Later assessment of his thermal burns indicated some full thickness thermal burns on the hands. The thermal burns were assessed as involving 6% of his body surface area (4% full thickness). Autografts were applied to the hands on April 21, 1993.

I have been advised by the OSC that Mr. Doyle was seen leaving the burning complex. At that time, his hands were described as being in flames. The police laboratory detected the presence of an accelerant on his clothing, including on the sleeves of his jacket.

Conclusion: The uniform diffuse burning of his hands and his hands being in flames is consistent with being caused by ignition of an accelerant that had been spilled or splashed onto the skin of the hands. Pushing against a burning door or wall does not typically cause this type of burning.

III-2C. Carlos Ghigliotty

The OSC asked me to review the death of Carlos Ghigliotty (DOB 5/4/57). I understand Mr. Ghigliotty was a FLIR expert retained by the Government Reform and Oversight Committee and was in contact shortly before his death with Mr. Caddell, Davidian plaintiffs' attorney, regarding the ongoing civil litigation. Mr. Ghigliotty's death was officially investigated by the Laurel, Maryland Police Department and the State of Maryland's Office of the Chief Medical Examiner.

Mr. Ghigliotty had not been seen for approximately 2 weeks prior to the discovery of his body. The owner of the building in which the body was found used a pass key to enter Mr. Ghigliotty's office to check on his welfare on April 28, 2000. Mr. Ghigliotty was dead and the owner immediately contacted the police department. The decedent was laying supine on an air mattress in his office. The room was deadbolted and the blinds were closed. The office was secure and no evidence of foul play was apparent. A partially eaten sandwich was present. A wrapper dated April 3 was found in the trash. A torn cold/flu medication packet was present in the room. The decedent was known to spend extended periods of time in his office.

A thorough complete autopsy was performed on April 29, 2000 by the Maryland State Medical Examiner's Office (00-2354-027 OCME–MD). The body was moderately decomposed. No injuries were identified. The circumflex coronary artery was narrowed 40-80% by atherosclerosis. Microscopic examination of the heart demonstrated focal scarring of the heart muscle (myocardium). There was also some arteriosclerosis of the small blood vessels of the kidneys. Toxicologic studies demonstrated acetaminophen (non-narcotic analgesic and antipyretic agent) and chlorpheniramine (antihistamine) in the urine. These agents are common components in over the counter cold/flu medications such as were found in his office. No other drugs were identified. Ethanol and isopropanol were found in the blood and urine. The alcohols are consistent with decomposition. The cause of death was ascribed to a cardiac rhythm disturbance due to arteriosclerotic cardiovascular disease. The manner of death was indicated as natural. The cause/manner of death opinions were signed by the associate, assistant and chief medical examiners.

Conclusion: My review of the investigative and autopsy reports along the with photographs of the scene of death and the body support the observations and conclusions of the Maryland medical examiners. I agree with their opinion that Mr. Ghigliotty's death was a natural death due to his arteriosclerosis. There is no evidence to suggest foul play caused or contributed to his death.

Cause of Death: Arteriosclerotic heart disease.

Manner of Death: Natural

Report submitted on September 26, 2000.
Michael Graham, M.D.

CURRICULUM VITAE

NAME: Michael Alan Graham

OFFICE ADDRESS:

Division of Forensic and Environmental Pathology St. Louis University School of Medicine 3556 Caroline St. St. Louis, Missouri 63104 (314) 577-8298 Office of the Medical Examiner City of St. Louis 1300 Clark St. St. Louis, Missouri 63103 (314) 622-4971

PERSONAL HISTORY:

Date of Birth- 9/26/51
Place of Birth- East Liverpool, Ohio
Citizenship--- United States of America
Marital Status- Married
Children----- Christopher (12-11-87)

Patrick (4-8-90)

EDUCATION:

1965-1969	Ursuline High School, Youngstown, Ohio
1969-1973	B.A.(biology), St. Louis University, St. Louis, Missouri
1973-1977	M.D., St. Louis University School of Medicine, St. Louis, Missouri

PROFESSIONAL TRAINING:

1977-1981	Resident, Anatomic and Clinical Pathology, St. Luke's Episcopal Hospital, Houston, Texas
1981-1982	Fellow, Forensic Pathology, St. Louis University School of Medicine, St. Louis, Missouri

MEDICAL LICENSURE:

1. Missouri

SPECIALTY CERTIFICATION:

- 1. Diplomate, American Board of Pathology
 - A. Anatomic and Clinical Pathology, 1981
 - B. Forensic Pathology, 1982

ACADEMIC APPOINTMENTS:

- 1979-1981 Lecturer in Pathology, School of Pharmacy, University of Houston, Houston, Texas
- 1982-6/30/89 Assistant Professor of Pathology, St. Louis University School of Medicine, St. Louis, Missouri
 - 7/1/89-6/30/96 Associate Professor of Pathology, St. Louis University School of Medicine, St. Louis, Missouri
 - 1. Pathology Residency Committee(1986-1989)
 - Director, Division of Forensic and Environmental Pathology (1989-1996)
 - 3. Director, Medicolegal Death Investigator Training Course (1989-1996)
 - 7/1/96-current Professor of Pathology, St. Louis University School of Medicine, St. Louis, Missouri
 - Co-director, Division of Forensic and Environmental Pathology (1996-current)
 - Co-director, Medicolegal Death Investigator Training Course (1996-current)

PROFESSIONAL ACTIVITIES:

1982-1985	Assistant Medical Examiner, St. Louis, MO
1985-1989	Deputy Chief Medical Examiner, St. Louis, MO
1985-current	Deputy Medical Examiner, St. Louis County, MO
1985-current	Diagnostic Cardiac Pathology, St. Louis University School of Medicine, St. Louis, MO
1988-current	Medical Staff, St. Louis University Hospital, St. Louis, MO
1986-current	Deputy Chief Medical Examiner, St. Charles County, MO
1989-current	Chief Medical Examiner, St. Louis, MO
1992-current	Deputy Chief Medical Examiner, Jefferson County, MO

INVITED LECTURES (Partial Listing):

```
Medicolegal Death Investigator Training Course, St. Louis
University School of Medicine
       1982-current Asphyxial Deaths
1985-current Deaths Due to Bombs and
1985-current Deaths Due to Firearms
                     Deaths Due to Bombs and Explosions
       1988-current Introduction to Forensic Pathology
       1997-current
                     Deaths Occurring in Custody
Forensic Administration Conference, St. Louis University
School of Medicine
             Decision-Making Methods That Will Aid in Determining Standard Operating
             Procedure for Case Acquisition and Handling Techniques
Washington University Dental School
            Basic Forensic Pathology
   1984-88
St. Luke's Episcopal Hospital (Houston, Texas)
   1984
             Selected Topics in Forensic Pathology (5 day lecture series)
St. Louis Metropolitan Major Case Squad
   1986-87 Asphyxial and Firearm Deaths 5/22/90 Asphyxial and Firearm Deaths
St. Louis Police Academy Homicide Investigation Training Course
            Asphyxial and Firearm Deaths
American Academy of Forensic Sciences
   1988 Annual Lectureship in Forensic Toxicology
                    "Safe Handling of Contagious Specimens"
Symposium on Care of the Multiple Trauma Patient sponsored by The University Hospital
and The American Association of Critical Care Nurses, St. Louis, MO
         "Mechanisms of Firearm Injuries" (5/24/89)
         "Investigative Aspects of Forensic Pathology" (5/11/90)
         "Interpretation of Firearm Injuries" (5/3/91)
Annual Court Conference, Missouri Association for Court Administration (5/25/89)
         "The Risk of AIDS Among Courtroom Personnel"
Statewide Conference on Sudden Infant Death Syndrome, Columbia, MO (10/6/89)
             "SIDS - Evaluation of the Death Scene as a Necessary Component of the
          Diagnosis"
Pre-hospital Trauma Symposium sponsored by St. Louis University Medical Center, St.
Louis, MO
```

"Postmortem Perspectives" (3/2/90)

"Postmortem Forensic Examination" (9/28/90)

Southwestern Illinois Law Enforcement Commission Homicide & Criminal Sexual Assault Seminar (4/19/90)

"Modes of Violent Death"

Symposium on Pediatric Trauma ("A step beyond resuscitation for the severely injured child") sponsored by Cardinal Glennon, Children's and St. Louis Children's Hospitals (11/2/90)

"Forensic Aspects of Pediatric Trauma"

Fifth Annual Mid-America Transplant Association "Gateway to Life" Symposium, St. Louis, MO (4/26/91)

"Role of the Medical Examiner in Organ & Tissue Donation"

National Convention of the National Association of Legal Investigators, St. Louis, MO (6/18/92)

"The Role of the Forensic Pathologist in Medical/Legal Investigations"

Eighth Medicolegal Investigation of Death Seminar, West Virginia University School of Medicine, Morgantown, WV (4/3/93)

"Deaths Due to Asphyxia"

"Deaths Due to Bombings and Explosions"

Forensic Pathology Symposium, Peoria, IL (5/15/93)

"Deaths Due to Firearms"

"Deaths Due to Bombings and Explosions"

Missouri Department of Health Seminar ("SIDS-Taking Care of the Caregiver"), St. Louis, MO (6/30/93)

"Diagnosis of SIDS-Parameters and Significance"

Citizen's for Missouri's Children Seminar (Kids Count in Missouri), St. Louis, MO (11/3/93)

"What Kids Count Outcome Measures Tell Us About Child Safety"

Washington University Medical Center, Department of Neurosurgery Grand Rounds, St. Louis, MO (1/12/94)

"Interpretation of Firearm Injuries"

Washington University Medical Center, Trauma Symposium ("Crisis in the Streets"), St. Louis, MO (2/25/94)

"Recognition & Interpretation of Injuries & Evidence"

Cardinal Glennon Children's Hospital, Grand Rounds, St. Louis (4/6/94)

"Identifying Death Due to SIDS-Where are we and Where are we Going?"

Minnesota Coroners' and Medical Examiners' Association Annual Forensic Science Seminar (October 6-7, 1994)

"Medicolegal case management"

"Injury and Death Due to Firearms"

"Asphyxial Deaths"

"Bombs and Expolsions"

"Role of the Medical Examiner in Organ and Tissue

Transplantation"

"Deaths in Police Custody"

Medicolegal Investigation of Death and Injury in Child Abuse and SIDS Seminar, Federal Bureau of Investigation and the College of American Pathologist, Salt Lake City, UT (August 14, 1995)

"Sudden Infant Death Syndrome-Investigation and Diagnosis"

American Society of Clinical Pathology --College of American Pathologists fall meeting, New Orleans, LA (September 21, 1995)

"Forensic Aspects of Pulmonary Pathology"

1996 Spring Training Session, Missouri Coroners & Medical Examiners Association, Jefferson City, MO (March 14, 1996)

"Asphyxial Deaths"

"Deaths in Police Custody"

American Society of Clinical Pathology - College of American Pathologists spring meeting, Boston, MA (4/24/96)

"Medicolegal Evaluation of Deaths in Custody"

American Association of Pathologists' Assistants Annual Conference, St. Louis, MO (9/20/96)

"Medicolegal Case Management - What to Do, When to Do it & What it Means"

American Society of Clinical Pathology -- College of American Pathologists fall meeting, San Diego, CA (October 3, 1996)

"Forensic Aspects of Pulmonary Pathology"

Missouri State Public Defenders Trial Skills Workshop, Lake of the Ozarks, MO (12/96)
"Introduction to Forensic Pathology"
"Injuries due to Firearms"

American Society of Clinical Pathology -- College of American Pathologists spring meeting, Chicago, IL (April 5, 1997)

Covert Hazards in the Work place" in "The Role of the Pathologist in the Evaluation of Work-Related Illness, Injury and Death"

POST Blast Investigation Training, Fort Leonard Wood, MO (6/5/98)
Forensic Pathology-Explosions"

Northwestern University Traffic Institute $21^{\rm st}$ National Vehicular Homicide/DUI Conference, Chicago, IL (7/7/98)

"Forensic Pathology and the Vehicular Homicide Case"

Department of Surgery Grand Rounds, St. Louis University, St. Louis, MO (9/3/98) "Firearm Injuries"

Child Death Investigation Seminar; Idaho Dept. of Health and Welfare, St. Luke's Regional Medical Center CARES program, Idaho Dept. of Law Enforcement POST Academy; Boise, Idaho (9/8-9/98)

"Child Fatality Review in Missouri"

"Introduction to Death Investigation Principles"

"Evaluation of Suspected Rebreathing Incidents"

"Head and Neck Injury and Shaking"

Presentation of cases (multiple topics)

American Academy of Forensic Sciences workshop: Postmortem Pediatric Forensic Toxicology-Issues in Childhood Poisoning, Orlando, FL (2/19/99)

"Preparing for and recognizing potential toxicologically-relate pediatric deaths:

A forensic pathology perspective"

"Case roundup: A survey of interesting and unique cases"

American Academy of Forensic Sciences Annual Meeting, Orlando, FL (2/22/99) "Asphyxial deaths"

Greater St. Louis Area Major Case Squad $34^{\rm th}$ Annual Retraining Session, St. Louis, MO (3/8/99)

"Evaluation of Deaths Related to Custody"

"Medicolegal Evaluation of Death and Injury due to Explosion"

POST Blast Investigation Training, Fort Leonard Wood, MO (4/20/99) "Explosion Investigation-Role of the Forensic Pathologist"

Emergency medicine grand rounds, Barnes-Jewish Hospital, St. Louis, MO (8/10/99) "Firearms and ballistics"

Barnes-Jewish Hospital Trauma Symposium, St. Louis, MO (2/4/00) "Interpretation of Patterns of Injury"

Missouri Dental Association, Missouri Emergency Response Identification Team, Jefferson City, MO (2/5/00)

"Introduction to Forensic Pathology"

"Firearm Injuries"

"Investigation of Deaths Due to Explosions"

"Asphyxial Deaths"

American Academy of Forensic Sciences Annual Meeting, Reno, NV (2/24/00)

"Asphyxial Deaths"

"Gunshot Wounds"

American Society of Clinical Pathology-College of American Pathologists Spring Meeting, Boston, MA (4/8/00)

"Forensic aspects of pulmonary pathology"

SOCIETIES & ACTIVITIES:

```
American Academy of Forensic Sciences
       Program Co-chairman, 1984 national meeting, Anaheim,
       California
       Plenary Program Co-chairman, 1987 national meeting, San Diego,
       California
       Pathology/Biology Section Secretary (1991-92)
       Pathology/Biology Section Chairman (1992-1993)
       Pathology/Biology Section Program Committee (1997-1998)
National Association of Medical Examiners
       Education and Publications Committee (1986-1996)
       Tissue Banking Committee (1986-1993)
       Committee on Pediatric Toxicology Registry (1986-1992)
       Committee on Medical Device Malfunction (1987)
       Board of Directors (1988-current)
       Secretary-Treasurer (1989-current)
College of American Pathologists
       Forensic Pathology Committee (1989-1999)
United States and Canadian Academy of Pathology
Society for Cardiovascular Pathology
Sudden Infant Death Syndrome Resources
       Medical Advisory Board (1988-1995)
American Board of Pathology
       Forensic Test Committee (1992-1997)
Mid-America Transplant Association
       Board of Directors (1991-current)
American Journal of Forensic Medicine and Pathology
        Editorial Board (1992-current)
State of Missouri East Regional Trauma Committee
        Member (1992-disbanded circa 1994)
Missouri State Child Fatality Review Board
       Spokesperson, Pathologists' Network (1992-1996)
American Red Cross, Tissue Services
```

National Medical Examiner/Coroner Advisory Committee (1999-current)

AWARDS:

President's Award, Sudden Infant Death Syndrome Resources (1986)

Health Professional of the Year (1992), Combined Health Appeal of Greater St. Louis

Gift of Life Award, Mid-America Transplant Services and the National Kidney Foundation (1995)

Outstanding Service Award, National Association of Medical Examiners (1999)

Roland Quest Annual Award, Dept. of Pathology, St. Louis University (4/26/00)

PUBLICATIONS:

- 1. Graham, M., Butler, D. and Milam, J., "Thoracic Aortic Thrombi and Hypercoagulability," Cardiovascular Diseases, Dec. 1981, pp. 475-479.
- Graham, M., Poklis, A., Mackell, M. and Gantner, G, "A Case of Suicide Involving the Concommitant Intravenous Injection of Barbital and the Oral Ingestion of Arsenic," Journal of the Forensic Sciences, JFSCA, Vol. 28, No. 1, Jan. 1983, pp. 251-254.
- 3. Bagherian, V., Graham, M., Gerson, L.P. and Armstrong, D.L., "Double Pituitary Glands with Partial Duplication of Facial and Forebrain Structures with Hydrocephalus," Computerized Radiol., Vol. 8, No. 4, 1984, pp. 203-210.
- 4. Cohle, S.D., Graham, M.A., "Sudden Death in Hemodialysis Patients," Journal of Forensic Sciences, JFSCA, Vol. 30, No. 1, Jan. 1985, pp. 158-66.
- 5. Mackell, M., Gantner, G., Poklis, A. and Graham, M., "An Unsuspected Arsenic Poisoning Murder Disclosed By Forensic Autopsy" American Journal of Forensic Medicine and Pathology, 6(4):358-361, Dec, 1985.
- 6. Cohle, S.D., Graham, M.A. and Pounder, D.J., "Nonatherosclerotic Sudden Coronary Death," Pathology Annual, Vol. 21, Part 2: pp. 217-249, 1986.
- 7. Poklis, A., Mackell, M. and Graham, M., "Disposition of Cocaine in Fatal Poisoning in Man," J Analytical Toxicology, Vol. 9, Sept/Oct, 1985.
- 8. Graham, M., Hileman, F., Kirk, D., Wendling, J. and Wilson, J., "Background Human Exposure to 2,3,7,8-TCDD," Chemosphere, Vol. 14, No. 6/7, pp. 925-928, 1985.

- 9. Graham, M., Hileman, F. D., Orth, R. G., Wendling, J. M. and Wilson, J. D., "Chlorocarbons in Adipose Tissue From a Missouri Population," Chemosphere, Vol. 15, Nos. 9-12, pp 1595-1600, 1986.
- 10. Newman, A.J., Graham, M.A., Carlton, C.G., Jr., Lieman, S.: "Incidental carcinoma of the prostate at the time of transurethral resection: Importance of evaluating every chip." J. Urol 1982; 128:948-50.
- 11. Hope, W., William, J., Gantner, G. and Graham, M., "Unacceptable Causes of Death," Metro Medicine, pp. 432-435, September, 1986.
- 12. Sotelo-Avila, C., Graham, M., Hanby, D. and Rudolph, A., "Nevus Cell Aggregates in the Placenta--A Histochemical and Electron Microscopic Study," Am J Clin Path 1988; 89:395-400.
- 13. Cohle, S., Graham, M., Dowling, G. and Pounder, D., "Sudden Death and Left Ventricular Outflow Disease," Pathology Annual 1988 (Part 2): 97-124.
- 14. Cohle, S., Trestrail, J., Graham, M., Oxley, D., Walp, B. and Jachimczyk, J., "Fatal Pepper Aspiration," Am J Dis Child 1988:633-636
- 15. Cohle, S., Graham, M., Sperry, K. and Dowling, G., "Unexpected Death Due to Infective Endocarditis," Journal of the Forensic Sciences, JFSCA, Vol 34, No. 6, Nov. 1989, pp 1374-1386.
- 16. Poklis, A., Graham, M., Maginn, D., Branch, C. and Gantner,
 G., "Phencyclidine and Violent Deaths in St. Louis, Missouri:
 A Survey of Medical Examiners' Cases from 1977 through 1986,"
 Am J Drug Alcohol Abuse, 16(3&4), pp 265-274 (1990).
- 17. Kemp, J., Kowalski, R., Burch, P., Graham, M. and Thach, B., "Unintentional Suffocation by Rebreathing: A Death Scene and Physiological Investigation of a Possible Cause of Sudden Infant Death," J Pediatr 1993; 122:881-6
- 18. Miller, L., Wesp, A., Jennison, S., Graham, M., Martin, T., McBride, L., Pennington, D. and Peigh, P., "Vascular Rejection in Heart Transplant Recipients," J Heart Lung Transplant, 1993; 12:S147-52.
- 19.Zimmerman, S., Adkins, D, Graham, M., Petruska, P., Bowers, C., Vrahnos, D. and Spitzer, G., "Case Report: Irreversible, Severe Congestive Cardiomyopathy Occurring in Association with Interferon Alpha Therapy," Cancer Biotherapy 1994; 9:291-299.
- 20. Tracy, T.F., Silen, M.L. and Graham, M.A., "Delayed Rupture of the Abdominal Aorta in a Child Following a Suspected Handlebar Injury," J Trauma, 1996; 40:119-120.
- 21. Filkins, J.A., Cohle, S., Levy, B.K. and Graham, M.A., "Unexpected Deaths Due to Colloid Cysts of the Third Ventricle," J Foren Sci, JFSCA, 1996; 41:521-523.

- 22. Donoghue, E.R., Graham, M.A., Jentzen, J.M., Lifschultz, B.D., Luke, J.L., and Mirchandani, H.G., "Position paper: Criteria for the Diagnosis of Heat-Related Deaths," National Association of Medical Examiners, Am J Forensic Med & Pathol 1997; 18(1):11-14
- 23. Winters, G.L., McManus, B.M., for the Rapamycin Cardiac Rejection Treatment Trial Pathologists, "Consistencies and Controversies in the Application of the International Society of Heart and Lung Transplantation Working Formulation for Heart Transplant Biopsy Specimens," J Heart and Lung Transplantation, 1996; 15:728-735.
- 24. Long, C., Crifasi, J., Maginn, D., Graham, M., and Teas, S., "Comparison of Analytical Methods in the Determination of Two Venlafaxine Fatalities," J Analytic Tox, 21:166-169.
- 25. Graham, M and Hutchins, G, "Forensic Pathology-Pulmonary Pathology," Clin Laboratory Med, 1998; 18:241-262.
- 26. Randall BB, Fierro MF and Froede RC for the Members of the Forensic Pathology Committee, College of American Pathologists, "Practice Guideline for Forensic Pathology," Arch Pathol Lab Med, 1998; 122:1056-1064
- 27. Kemp J, Unger B, Wilkins D, Psara R, Ledbetter T, Graham M, Case M and Thach B, "Unsafe Sleep Practices and an Analysis of Bedsharing Among Infants Dying Suddenly and Unexpectedly: Results of a Four-Year, Population-based, Death-scene Investigation Study of Sudden Infant Death Syndrome and Related Deaths," Pediatrics, 2000; 106(3). URL: http://www.pediatrics.org/cgi/content/full/106/3/e41

BOOKS AND CHAPTERS:

- Graham, M. and Gantner, G., "Certification of Death," in <u>Forensic Pathology</u>, <u>A Handbook For Pathologists</u>, second edition. Northfield, IL: College of American Pathologists; 1990:pp 35-43.
- Graham, M. and Gantner, G., "Interacting With the Media," in <u>Forensic Pathology</u>, <u>A Handbook for Pathologists</u>, second edition. Northfield, IL: College of American Pathologists; 1990:pp 271-274.
- Graham, M. and Gantner, G., "Heat and Cold," in <u>Forensic Pathology</u>, <u>A Handbook for Pathologists</u>, second edition. Northfield, IL: College of American Pathologists; 1990: pp 165-169.
- 4. Gantner, G. and Graham, M., "Death Associated With Fire and Burns," in <u>Forensic Pathology</u>, <u>A Handbook for Pathologists</u>, Northfield, IL: College of American Pathologists; 1990: pp 159-163.
- 5. Gantner, G. and Graham, M., "Evaluating the Quality of the Medicolegal Autopsy Protocol," in <u>Forensic Pathology</u>, <u>A</u> <u>Handbook for Pathologists</u>, second edition. Northfield, IL: College of American Pathologists; 1990:pp 11-17.

- 6. Graham, M., "Pathology: Its Role in Personal Injury Litigation," in <u>Medical</u> <u>Evidence</u>, IICLE, Springfield, IL Chapter 8 (pp 1-22), 1990.
- 7. Graham, M., "Role of the Medical Examiner in Child Abuse," in <u>Child Maltreatment</u>, eds Brodeur, A. and Monteleone, J., G.W. Medical Publishing, Inc. St. Louis, MO, 1994
- 8. Graham, M., "Pathology: Its Role in Personal Injury Litigation" in Medical Evidence, IICLE, Springfield, IL (1997)
- 9. Graham, M., "Key Differences between the Role of the Coroner in the United States and the United Kingdom" in the <u>Oxford Textbook of Critical Care</u>, Webb A et al (eds), Oxford University Press, Oxford, UK; 1999:pg1044
- 10. Graham, M., and Hanzlick, R., <u>Forensic Pathology in Criminal Cases</u>, Lexis Law Publishing, Carlsbad, CA, 1997
- 11. Graham, M., "Role of the Medical Examiner in Child Abuse," in <u>Child Maltreatment</u>, second edition, eds Brodeur, A and Monteleone, J, G.W. Medical Publishing, Inc., St. Louis, MO, 1998
- 12. Graham, M., "The Medical Examiner, part 2," in <u>Child Maltreatment</u>, <u>A Comprehensive Photographic Reference Identifying Potential Child Abuse</u>, second edition, Monteleone, J, G.W. Medical Publishing, Inc., St. Louis, MO, 1998
- 13. Graham, M and Monteleone, J, "Identifying, Interpreting and Reporting Injuries," in <u>Quick Reference--Child Abuse</u>, Monteleone, J, G.W. Medical Publishing, Inc., St. Louis, MO, 1998
- 14. Graham, M, "Working with the Media and Methods of Disseminating Information," in <u>CAP Handbook for Postmortem Examination of Unidentified Remains</u>, Fierro, M (ed), College of American Pathologists, Northfield, IL, 1998.
- 15. Graham, M, "The Medicolegal Autopsy: Description of the Process," in <u>Medicolegal Death Investigation: Treatises in the Forensic Sciences</u>, 2nd edition, Caplan YH and Frank RS (eds), The Forensic Sciences Foundation, Colorado Springs, CO, 1999
- 16. Graham M and Hanzlick R, <u>Forensic Pathology in Criminal Cases-1999</u>
 <u>Companion</u>, Lexis Law Publishing, Charlottesville, VA, 1999
- 17. Dix J and Graham M, <u>Time of Death</u>, <u>Decomposition and Identification-An Atlas</u>, CRC Press, Boca Raton, FL, 2000
- 18. Dix J, Graham M and Hanzick R, <u>Asphyxia and Drowning-An Atlas</u>, CRC Press, Boca Raton, FL, 2000
- 19. Dix J, Graham M and Hanzlick R, <u>Investigation of Road Traffic Fatalities-An Atlas</u>, CRC Press, Boca Raton, FL, 2000

PAPERS PRESENTED:

- Newman, A., Graham, M. and Carlton, E., "ABO Antigens in CIS and Dysplasia of the Urinary Bladder," American Urologic Assn., San Francisco, California (1980)
- Newman, A., Graham, M., et al, "Incidental Carcinoma of the Prostate at the Time of Transurethral Resection: Importance of Evaluating Every Chip," American Urologic Assn., Boston, Mass. (1981)
- 3. Newman, A., Graham, M., et al, "ABO Antigens in Upper Urinary Tract Transitional Cell Tumors," American Urologic Assn., Boston, Mass. (1981)
- 4. Graham, M., Hayes, D., Gantner, G., "Medical Center Suicides," American Academy of Forensic Sciences, Anaheim, California (1984)
- Graham, M., McGivney, J., "Fatal Mediastinitis Following Dental Extraction," American Academy of Forensic Sciences, Anaheim, California (1984)
- Cohle, S.D., Graham, M.A, "Sudden Death in Hemodialysis Patients," American Academy of Forensic Sciences, Anaheim, CA (1984)
- 7. Cohle, S.D., Graham, M.A., "Nonatherosclerotic Sudden Coronary Death," International Academy of Forensic Sciences, Oxford, England (September, 1984)
- 8. Graham, M., Hileman, F., Kirk, D., Wendling, J. and Wilson, J., "Background Human Exposure to 2,3,7,8-TCDD," Fourth International Symposium on Chlorinated Dioxins and Related Compounds, Ottawa, Canada (October, 1984)
- 9. Graham, M., Wong, S. and Poklis, A., "Death Due to Inhalation of Maleic Anhydride," American Academy of Forensic Sciences, Las Vegas, Nevada (1985)
- 10. Gantner, G., Graham, M. and Gantner, T., "Provision of Lay Autopsy Reports to Families," American Academy of Forensic Sciences, Las Vegas, Nevada (1985)
- 11. Graham, M., Hileman, F., Wendling, J. & Wilson, J.

 "Chlorocarbons in Adipose Tissue Samples," Fifth
 International Symposium on Chlorinated Dioxins & Related
 Compounds, Bayreuth, Federal Republic of Germany (Sept. 1985)
- 12. Graham, M., Tsai, C., Miller, L., Williams, G., Tsai, L., and Martin, T., "Active Lymphocytic Myocarditis in Sudden Unexplained Death," International Academy of Pathology, Annual Meeting, New Orleans, Louisiana (March, 1986)

- 13. Graham, M., Hileman, F., Wendling, J., and Wilson, J., "Chlorocarbons in Adipose Tissue and Liver Tissue Samples," Sixth International Symposium on Chlorinated Dioxins and Related Compounds, Fukuoka, Japan (September, 1986)
- 14. Graham, M., and McCallister, HA, "The Spectrum of Myocardial Lesions Due to Catecholamines," National Association of Medical Examiners, Annual Meeting, Tucson, AZ (Nov., 1986)
- 15. Graham, M., "Evaluation of Human Exposure to Dioxins and Other Environmental Trace Contaminants," American Academy of Forensic Sciences (Plenary Session), San Diego, CA (Feb., 1987)
- 16. Burch, P., Graham, M., Poklis, A., "Sudden Death Associated with Phencyclidine," American Academy of Forensic Sciences, San Diego, CA (Feb., 1987)
- 17. Graham, M., Burch, P., Cohle, S., Bux, R., Poklis, A. and Lynch, R., "Recreational and Iatrogenic Fatal Water Intoxication," American Academy of Forensic Sciences, Philadelphia, PA (Feb., 1988)
- 18. Burch, P. and Graham, M., "SIDS or Infanticide?--Differentiating SIDS From Overlying and Other Forms of Infant Death When Autopsy Findings are Non-diagnostic," American Academy of Forensic Sciences, Philadelphia, PA (Feb., 1988)
- 19. Poklis, A., Maginn, D., Graham, M. and Gantner, G.,
 "Drug Abuse Trends in St. Louis, MO; 1977-86," American
 Academy of Forensic Sciences, Philadelphia, PA (Feb., 1988)
- 20. Graham, M., "The Forensic Examination of the Cardiac Transplant Recipient," National Association of Medical Examiners, Boston, MA (Nov., 1988)
- 21. Cohle, S., Graham, M., Sperry, K. and Dowling, G.,
 "Unexpected Death Due to Infective Endocarditis," American
 Academy of Forensic Sciences, Las Vegas, NV (Feb., 1989)
- 22. Pegors, C., Vogler, C., Graham, M. and Beeson, R., "Skeletal Muscle in Victims of SIDS: A Morphometric Assessment," American Society of Clinical Pathology, San Francisco, CA (1990) (Poster)
- 23. Kemp, J., Kowalski, R., Graham, M. and Thatch, T., "Positional Ventilatory Impairment in a Serial Study of 23 SIDS Cases", The American Pediatric Society and The Society for Pediatric Research, Boston, MA (May, 1992)
- 24. Jennison, S., Wesp, A., Graham, M., McBride, L., and Miller, L.,
 "Through Cyclosporin Levels in the Early Postoperative Period Do Not
 Influence the Rate of Subsequent Acute Cardiae Rejection," Third
 International Congress on Cyclosporine, Seville, Spain (March, 1994)

- 25. Graham, M., "Rebreathing It's Role in SIDS," National Association of Medical Examiners Interim Meeting, Seattle, WA (February, 1995)
- 26. Case, ME, Graham, MA and Wood JE, "Spinal Cord Injury in Child Abuse", National Association of Medical Examiners, Traverse City, Michigan (September, 1996)
- 27. Graham, MA and Case, ME, "Hyperthermia in St. Louis Evolution of a Community Response", National Association of Medical Examiners, Traverse City, Michigan (September, 1996)
- 28. Case ME, Graham MA and Wood JE, "Spinal cord injury in Child Abuse by Shaking," The Second National Conference on Shaken Baby Syndrome, Salt Lake City, Utah (September, 1998)

9/8/2000

Analysis of the Toxicity Hazards of Methylene Chloride Associated with the Use of Tear Gas at the Branch Davidian Compound at Waco, Texas on April 19, 1993

Prepared for

The Office of Special Counsel John C. Danforth

Ву

Dr. George Lucier

Pittsboro, North Carolina

September 15, 2000

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CO in blood and percentage COHb from 6:00 a.m. to 12:20 p.m. for different	
exposure scenarios	
Appendix C - Andersen ME, Clewell, HJ, Gargas ML et al. (Physiolgically-based	
pharmacokinetic modeling with dichloromethane, its metabolite carbon monoxid	le
and blood carboxyhemoglobin in rats and humans. Toxicol Appl Pharmacol	
108:14-27 (1991).	
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Appendix D - Credentials and curriculum vitae of George W. Lucier

Executive Summary

The Office of the Special Counsel retained me in December of 1999 to provide a toxicological evaluation of the possible effects of the methylene chloride (MC) exposures to the Branch Davidians inside the Waco Compound on April 19, 1993. MC exposures occurred as a consequence of its use as a solvent for solid CS in the tear gas ferret rounds and canisters. Specifically, I was asked to investigate the following two questions:

- ◆ Did the MC exposures inside the Waco Compound kill any of the Branch Davidians on April 19, 1993?
- Did the MC exposures inside the Compound significantly impair the judgment of the Branch Davidians such that they were unable to escape the fire on April 19, 1993?

My approach to this task was several fold involving:

- Analysis of the scientific literature for health effects and toxicity of MC in humans and experimental animals. Since MC is a commonly used solved in many industrial settings, there is a wealth of scientific literature available as well as the existence of numerous risk assessments made by Federal and State regulatory agencies. Rigorous analysis of the existing literature was not done in previous investigations.
- ♦ Analysis of the remains of the Branch Davidians for residues of MC. This was not done in previous investigations.
- Predictions of the uptake and retention of MC following various exposure scenarios for April 19, 1993. The predictions employed existing physiologically-based pharmacokinetic (PBPK) models for MC and were based on the MC exposure estimates made by Dr. Jerry Havens using information supplied by the Office of Special Counsel on the number and timing of tear gas ferret rounds fired (386) and canisters inserted (20) into the complex on April 19, 1993.

PBPK models predict the behavior of MC and it's breakdown products inside the body and have not been used in any previous analysis of possible toxicities caused by MC exposures encountered by the Branch Davidians. PBPK models are a commonly used tool in risk assessments made by Federal and State agencies as well as other organizations.

♦ Experiments were conducted in rats to determine if the carbon monoxide (CO) produced from MC inside the human body could render the animals less able to avoid or escape from an electric shock. When trapped in a fire people often asphyxiate from high carbon monoxide exposures. Because MC

exposure also produces CO in the blood, it was important to determine whether MC exposure prior to a fire could have possibly rendered some individuals inside the Compound less capable of escaping from the fire. Such experiments were not conducted in previous investigations.

Careful evaluation of the results of this strategy leads me to make the following conclusions:

- MC exposures did not kill any of the Branch Davidians on April 19, 1993. The
 highest blood concentrations predicted from a worst case exposure scenario was
 65 mg/L. This compares to the range of blood MC concentrations in cases of
 fatal MC poisoning of 281-700 mg/L.
- 2. MC is a central nervous system (CNS) depressant and this effect appears to be the most sensitive response following MC exposures of less than one day. Based on evaluation of several possible exposure scenarios and the application of PBPK models to the relevant data it is likely that some of the Branch Davidians experienced some form of CNS depression. This effect on CNS function could have led to decreased responsiveness to visual or auditory signals, irritation or dizziness. The mechanism for this response could possibly have been a direct effect of MC on the CNS or less likely oxygen deprivation from CO produced by MC degradation inside the body. Blood concentrations of 2-12 mg/L MC have been reported to cause mild CNS depression and higher blood levels of MC were likely experienced by some of the Branch Davidians at some point during the morning of April 19, 1993.
- 3. Children would likely be slightly more sensitive to a given air MC concentration than adults because of physiological differences between adults and children including the fact that children breathe faster than adults.
- 4. It is possible that exposure to MC during the morning of April 19, 1993 caused a few of the Branch Davidians to become unconscious from smoke inhalation slightly earlier than they would have if MC exposures had not occurred. Controlled testing provided evidence against this possibility as rats administered low levels of CO (mimicking MC metabolism to CO) followed by much higher CO exposures (mimicking fire exposure) exhibited the same or better escape reactions than rats receiving only the high CO exposure.
- The Branch Davidians were exposed to a mixture of chemicals (CS, MC and their metabolites) on April 19, 1993. Exposure to such mixtures raises some concerns because little is known regarding the toxicological consequences of exposure to complex mixtures.

I was retained by the Office of Special Counsel in December of 1999 while I was employed by the National Institute of Environmental Health Sciences (NIEHS), one of the National Institutes of Health which is administered by the U.S. Department of Health

and Human Services. On December 7, 1999, I requested and received permission to assist the Office of Special Counsel as part of my official duties with the understanding that I would not give information to or discuss the investigation with any government officials. My position at the NIEHS had two parts. One as a senior scientist and the other as Director of the Environmental Toxicology Program. In that capacity, I was responsible for coordinating the National Toxicology Program (NTP) generally considered the world's most comprehensive toxicology research and testing program. It's charged with providing toxicological evaluations on substances of public health concern. I retired from the NIEHS on June 30, 2000, after 30 years of service. My written report was prepared after I left government service.

Chemical Properties

Chemical Abstract Service

Methylene Chloride (MC) is a halogenated aliphatic hydrocarbon, a widely used class of chemicals. It is also known as dichloromethane and its structure is shown below

MC is a colorless liquid with a boiling point of 39.8°C. It is generally considered nonflammable and non-explosive.

MC has a number of trade names including Narkotil, Solaesthin and Solmethine. It has many identification numbers as indicated below:

75-09-2

C50102

Chemical Abstract Service	75-09-2
National Institute of Occupational Safety and Health Registry of Toxic Effects of Chemical Substances	PA 8050000
Environmental Protection Agency Hazardous Waste	U080F002
Oil and Hazardous Materials/ Technical Assistance Data System	7217234
Department of Transportation/ United Nations/North America/ International Maritime Dangerous Goods Code	UN1593,IMCD6.1
Hazardous Substances Data Bank	66

Production and Use

National Cancer Institute

MC is produced by the chlorination of methane with chlorine or by the chlorination of methanol with hydrogen chloride. Production of MC grew steadily through the 1970's and early 1980's with a peak production of about 620 million pounds in 1984. Since then there has been a small but steady drop in production. There are currently 867 facilities that produce or process MC in the United States including 41 in Texas.

MC is used as a solvent in paint strippers and removers, as a propellant in aerosols, as a process solvent in the manufacture of drugs, pharmaceuticals, and film coatings, as a metal cleaning and finishing solvent and in foam production. Aerosol products in which MC can be found include paints, automotive products and insect sprays. However, because of labeling regulations and concerns over health and environmental issues, the use of MC in consumer aerosol products has declined. MC was once used in hair sprays but the FDA banned this use in 1989. MC had been used extensively to remove caffeine from coffee, however because of concern over health risks; most decaffeinators no longer use MC. In any event, use of MC as a solvent in tear gas canisters and ferret rounds is a minor use of this commercially important solvent.

MC has been detected in ambient air samples taken from around the world. Background levels are usually about 50 parts per trillion (0.17 μ g/m³) (Singh, 1982). Concentrations in some urban areas and in the vicinity of hazardous waste sites are generally 10-100 times higher. These values are all much lower than the concentrations found inside buildings and in workplaces where MC is used.

Federal and State Regulations

Because of its widespread use Federal and State agencies have developed regulations for allowable levels in the workplace and general environment. Permissible levels in the workplace are generally far greater than those allowed in the general environment.

The Occupational Safety and Health Administration (OSHA) recently conducted a quantitative risk assessment (1998) for MC exposure in the workplace. Based on this assessment OSHA requires employers to keep exposure levels at or below 25 ppm (88 mg/m³) averaged over an 8-hour workday. Respirators must be used in circumstances where this level is exceeded. The OSHA regulation is based on central nervous system effects following short and long term exposures and cancer effects following long term or chronic exposures. EPA has calculated a reference concentration (i.e. safe exposure level) of 3-mg/m³ (1 ppm) based on a two-year inhalation study in rats, which did not detect adverse effects at or below 200 ppm. The Agency for Toxic Substances Disease Registry (ATSDR) established a short-term safe exposure level of 3 ppm and 0.3 ppm for long term exposures. In addition, a number of states have set acceptable ambient air concentration at the fence line of industrial facilities. Some current Federal and state regulations are indicated below:

OSHA	Maximum Peak for 8 hour	25 ppm
EPA	Safe Exposure Level (Chronic)	1 ppm
Massachusetts	Acceptable Ambient Level	0.0008 ppm
New York	Acceptable Ambient Level	0.009 ppm

North Carolina	Acceptable Ambient Level	0.008 ppm
Washington State		0.007 ppm

These regulations employ a large margin of safety and can be considered a virtually safe dose for breathing MC over a lifetime. Most states allow much higher levels for short-term exposures than for lifetime exposures.

Health Effects

There have been a number of studies that have examined health effects from MC exposure. These studies have examined adverse effects in people exposed to MC vapors in the workplace and in animals exposed to varying amounts of MC administered by varying routes (i.e. inhalation, ingestion or skin contact). Some of the studies evaluated effects arising from long term exposures (months or years) while others evaluated shorter-term exposures (one day or less). Information on the shorter-term exposures is, of course, most relevant to the situation for the Branch Davidians in Waco on April 19, 1993 so I will focus on those effects in my evaluation. For example, there have been several studies that have determined that MC exposures at high lifetime concentrations (> 3000 mg/m³) causes cancer in rodents. The chances that exposure to high concentrations of MC for one day would cause cancer is remarkably close to 0. In the very remote probability that such exposure did cause cancer, this cancer would not become clinically detectable for at least 10 years. The U.S. Department of Health and Human Services has classified MC as "Reasonably anticipated to be a human carcinogen" and the World Health Organization classifies it as a possible human carcinogen. Although cancer effects of MC in people exposed occupationally or environmentally has been a highly controversial issue in regulating decision making by agencies such as OSHA, EPA, CPSC and FDA) it is of little concern regarding use of MC as a solvent in tear gas in riot control or crowd control situations.

There are publications in the scientific literature that have evaluated a number of noncancer effects of MC and these are summarized below. These are of more interest to the Waco investigation.

Organ or System Evaluated	<u>Findings</u>
Death	High exposures for 4 hrs (> 17,000 ppm) can cause death in experimental animals and people
Neurological	Mild effects on central nervous system function by doses as low as 200 ppm for 4 hrs or 300 ppm for 1.5 hrs in workers.

More severe effects such as unconsciousness occur at high exposures (about 10,000 ppm/ 4 hrs)

Cardiovascular Very high exposures (10,000 - 30,000

ppm) might cause cardiac arrhythmias based on studies in animals but no such effects have been detected in people

exposed to MC occupationally.

Respiratory High exposures (8400 ppm for 13

weeks) caused lung inflammation in rodents. The clara cells of the lung appear to be sensitive to MC. Irritative symptoms of the respiratory tract have been observed in people using large amounts of MC-based solvents.

Gastrointestinal No reported effect of MC

Hematologic Elevated carboxyhemoglobin levels

following occupational exposures to MC which diminishes oxygen carrying capacity of red blood cells. This could cause unconsciousness and possibly death following very high exposures and

could exacerbate existing cardiac

conditions.

Liver No reported effects of MC in humans

although chronic exposure to MC causes liver damage in rodents.

Kidney Effects No reported effects in people although

mild kidney damage seen in rats exposed to MC for 100 days.

Immune Effects No reported effects in people although

some spleen effects were observed in rats and dogs after chronic exposure.

Reproductive and Developmental One study reported low sperm counts in

MC-exposed workers however extensive studies in experimental animals did not detect effects on

Effects

8

reproduction or development.

Based on the above summary, the health endpoints of interest for the Waco investigation are death, unconsciousness and central nervous system effects because these effects can occur following short-term exposures (6 hrs or less) to sufficiently high concentrations of MC. Each of these endpoints is discussed in more detail in the following narrative.

Death

There are several case studies in the scientific literature, which clearly demonstrate that MC can be fatal to humans when large amounts are used in poorly ventilated areas. The most common cases of fatal poisonings have occurred in paint stripping operations. Other cases of death occurred in metal cleaning operations, in workers burying barrels containing MC, and cleaning of underground storage tanks with MC-based solvents.

The air concentrations of MC that caused death was not reported or estimated in most cases. However, these were all very high exposures and in some cases may have been over 100,000 ppm for several hours. Information from rodent studies indicates that 16,000 - 19,000 ppm MC for several hours is fatal to rats and mice. These same studies indicated that there is a narrow margin between the concentrations that cause unconsciousness and death. For example, no deaths occurred in mice exposed to 16,800 ppm for 4 hrs although all mice were unconscious. In contrast, 70% of mice died when exposed to 17,250 ppm for 4 hrs.

One way of comparing MC exposures that are known to have been fatal to exposures that occurred in Waco, is to compare blood levels of MC across several studies. In the case of MC-caused fatalities blood concentrations have ranged from 281 mg/L to 710 mg/L although blood MC measurements were not made in most fatal cases. Unfortunately, I could not find any cases where blood MC measurements were quantified in individuals who were rendered unconscious by MC and did not die. Since the exposure level required to cause unconsciousness is roughly 1/2 that required to cause death, it is reasonable to assume that blood concentrations of greater than 100 mg/L would be required to cause unconsciousness.

Neurological Effects

MC acts on the central nervous system (CNS) as a CNS depressant. Mild forms of CNS depression have been described in people following exposures as low as 200 ppm for several hours. The measures of CNS depression included subtle changes in visual and auditory functions. These findings were characterized by the authors as decreased vigilance and responsiveness to visual and auditory signals. The MC exposure that produced these effects are roughly equivalent to a blood concentration of approximately

4 mg/L (approximately 1/100 of a lethal amount) and a carboxyhemoglobin (COHb) level of 6%. These effects would be similar to someone consuming 2-3 drinks over a 1-2 hr period. Other studies, measuring different neurological endpoints were negative. Higher concentrations of MC cause lightheadedness, difficulty in maintaining concentration, dizziness, irritation, and unconsciousness as summarized below:

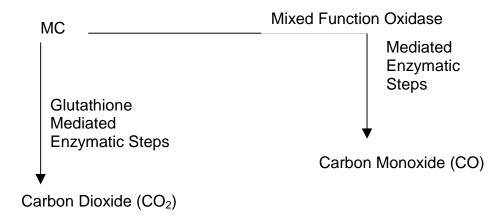
			Estimated Blood Concentration	
Effect	Concentration ppm	Exposure Concentration	MC (mg/L)	COHb (%)
Odor Threshold	100-300	On exposure		
No acute effects	100-200	Up to 7.5 hrs	1-2	3-5
Altered responses on sensory and psychomotor tests	200-800	At least 40 min	2-12	5-10
Lightheadedness	500-1000	1-2 hr	7-20	7-12
Irritation, dizziness	2300	30 min	20	10
Paresthesia	7200	10 min	40	6
Unconsciousness	8000-20,000	30 min - 4 hr	100	

These effects and the corresponding blood MC and COHb levels will be evaluated in relation to estimated MC exposure in Waco in the section on physiologically based pharmacokinetic models.

Absorption and Metabolism of Inhaled MC

Evaluation of pulmonary uptake in humans demonstrates that 70-75% of inhaled MC vapor is absorbed. Absorption is rapid, and once exposure ceases, MC is rapidly cleared with only trace levels being present 6 hrs even after exposure to high concentrations of MC. Excretion of MC occurs in expired air and urine. Following exposure of volunteers to 350 ppm MC for 3-hrs, blood concentrations averaged 5.9 mg/L. This compares to the blood levels of 280-700 mg/L in fatal poisonings from MC exposure.

There are two pathways by which inhaled MC is metabolized inside the body illustrated in the figure below:



One pathway utilizes an enzyme system called the mixed function oxidases and this pathway produces carbon monoxide (CO). The other pathway involves glutathione transferase enzymes leading to carbon dioxide (CO₂) production. Although both enzyme systems function in people exposed to MC, the preferred pathway appears to be the mixed function oxidase system. Therefore, people exposed to MC have elevated levels of CO in their bodies.

Inside the body, CO binds to hemoglobin to produce carboxyhemoglobin (COHb). When hemoglobin is bound to CO it cannot bind oxygen leading to potential health concerns arising from diminished blood oxygen levels in the brain and other tissues. In two fatal cases of MC poisoning COHb was elevated to 30% of total hemoglobin. In several non-fatal cases of MC exposure, COHb increased from 1% to 4-15%. COHb is much more persistent in the body than either unbound CO or MC and this property makes COHb a good biomarker for exposures to MC. The half-life of COHb in people is approximately 5 hrs, which means that once formed, one half of the total amount of COHb is degraded after 5 hrs. In addition, some MC is stored in the adipose tissue and slowly released to the blood so COHb is still being formed several hours after MC exposure.

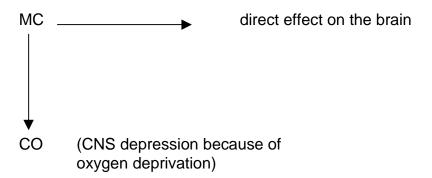
CO exposures can occur in a number of different ways. For example, CO produced from cigarette smokers leads to a significant enhancement of COHb levels. COHb levels in heavy smokers average 4-5%. In addition, CO-exposure occurs in fires and results in oxygen deprivation and asphyxiation. COHb levels in cases of fatal asphyxiation range from 20-70%. COHb levels are elevated in firefighters to levels up to 20%.

It is well known that different individuals have different sensitivities to the adverse effects of chemical exposures and MC is no exception. Sensitivity is often based on a variety of factors including genetic predisposition, gender, age (children or the elderly), diet, and co-exposure to other chemicals. There is good evidence in the scientific

literature that people vary in their ability to metabolize or degrade MC, which would cause some people to be more sensitive than others to MC-mediated toxicities such as central nervous system effects. There is little information available on the possible sensitivity of children to MC exposure. However, children would likely absorb slightly more MC than adults from inhalation exposures because they have a faster breathing rate. It is estimated that the variation in MC metabolism to CO would vary 2-3 fold in the human population. This means that if 100 people were exposed to the same concentration of MC for the same period of time one person might have 10 units of MC in their body whereas another could have 20-30 units.

Role of Metabolism in Neurotoxicity

There are two possible ways for MC to cause neurological effects such as CNS depression. The first is oxygen deprivation of the brain as a consequence of MC conversion to CO in the body and subsequent binding to hemoglobin. The COHb complex prevents oxygen from binding to hemoglobin, which in turn prevents sufficient amounts of oxygen from reaching critical organs such as the brain. If this mechanism were entirely responsible for the MC-mediated neurotoxicity, then COHb levels should be a good predictor of neurotoxic effects but they are not. Several studies have shown that MC-induced unconsciousness can occur in cases where there is only a small increase in COHb. Moreover, in some cases high concentrations of COHb have been observed in workers exposed to MC or CO without effects on the central nervous system. These findings have led to the scientific consensus that MC must have central nervous system effects, which are independent of COHb concentrations. This second possible mechanism for CNS depression is not well understood and it may or may not require metabolism of MC. Of course, both possible mechanisms may be acting in concert to produce neurological changes.



Therefore, prediction of possible neurological changes in the Branch Davidians will require consideration of both peak MC levels in the blood and peak COHb levels during the six-hour period that preceded the fire on April 19, 1993.

Physiologically-Based Pharmacokinetic (PBPK) Models for Estimating the Amounts and Fate of Methylene Chloride in the Branch Davidians on April 19, 1993

It is impossible to know with absolute certainty the exposures that the Branch Davidians encountered on April 19, 1993. However, we do have good information on the number of ferret rounds and canisters emptied into the Compound. We also have reliable information on the times that the ferret rounds were fired or the canisters inserted. According to the information supplied to me by the Office of Special Counsel 386 ferret rounds were fired and 20 canisters inserted as described in the report provided to the Office of Special Counsel by Dr. Jerry Havens. This information was applied to the COMIS computer model to estimate the concentrations of MC in each room of the compound from 6:00 a.m. to 12:20 p.m. The COMIS model estimates the effect of ventilation in each room on the dissipation of MC after ferret rounds were fired or canisters inserted. Thus, highly ventilated rooms would be predicted to retain MC for a shorter period of time than rooms where there is poor ventilation. These models which are reported in the analyses of Dr. Jerry Havens assumed that all ferret rounds entered the building and completely discharged their contents, which is unlikely, and so is a worst case scenario. Based on information supplied to us by the Office of Special Counsel and confirmed by Dr. Jerry Havens it is assumed that each ferret round contained 33.25 g MC and each canister contained 1070 g MC.

These data, supplied to me by Dr. Havens, were applied to PBPK models for predicting the uptake metabolism and retention of MC in blood and the formation and retention of COHb. A short description of the use of PBPK models follows.

PBPK Models are Commonly Used in Risk Assessment

PBPK models use mathematical descriptions of the uptake and disposition of chemical substances to quantitatively describe the movement of a chemical and its breakdown products over time inside the body following different exposure scenarios. PBPK models are also called biologically based tissue dosimetry models. They are being used increasingly in risk assessments designed to set safe exposure levels for a wide variety of chemical substances in the workplace or the general environment. The U.S. Environmental Protection Agency (EPA), The Occupational Safety and Health Administration (OSHA), The Food and Drug Administration (FDA), and the National Toxicology Program (NTP) use PBPK models as an important scientific tool important in meeting their regulatory and public health mandates. These agencies or organizations use PBPK models to predict the concentration of a given chemical that will be delivered to a particular part of the body following various combinations of route, dose level and species. PBPK models are most credible and useful in making health assessments when they are validated for multiple exposure scenarios. In other words, when model predictions are shown to be accurate when compared to real data for some exposure scenarios, they become more useful in predicting chemical disposition following exposure scenarios for which real data are not available. In the case of MC, PBPK

models have been used by OSHA, EPA, the Agency for Toxic Substances Disease Registry (ATSDR) (responsible for making health assessments for people residing in the vicinity of superfund sites) and several states as a key component in setting standards of acceptable exposures for MC.

PBPK Models for MC

We are fortunate to have a scientifically credible model for evaluating MC exposure encountered by the Branch Davidians (Andersen et al., 1991). A schematic representation of the model is found in Andersen's full paper in Appendix C.

This model describes the uptake, metabolism, tissue distribution and excretion of MC and CO in both rats and humans following inhalation exposure. It also models the formation and retention of COHb. Predictions in humans from the model were compared to several data sets in the scientific literature from volunteers exposed to CO or MC. An example of some of the human data used in model development is given below.

Concentrations of MC and COHb in venous blood samples from volunteers exposed to 350-ppm MC vapor for 6 hrs.

Time (hr)	Blood MC (mg/L)	COHb (% of Total Heme)
	, ,	,
0	0.016	1.5
3	5.9	5.3
5	5.9	7.6
Exposure stopped at 6 hrs		
7	0.9	9.0
12	0.3	6.5
22	0.08	3.8
30	0.04	1.9

In humans, the model was consistent with all available human data that ranged in exposure concentration for 50 - 1000 ppm and duration of exposures from 2 - 8 hrs. Likewise, in rats the model accurately predicted MC behavior following 4 hr exposures to 200 or 1000 ppm MC as well as a 1/2-hr exposure to 5160 ppm. Therefore, the model appears to be valid for both rats and humans over a wide exposure range for MC. We conclude that the Andersen model is the best scientific tool available to predict the uptake and disposition of MC inside the bodies of the Branch Davidians on April 19, 1993. It is worth noting here that none of the previous evaluations of the potential

health effects of MC at Waco used these models or in any way attempted to evaluate the amount of MC inside the bodies of the Branch Davidians. These previous investigations are therefore, incomplete.

<u>Application of PBPK Models for MC Exposures to Adults and Children inside the Branch</u> Davidian Complex

Six exposure scenarios were used for the PBPK models. All of them assumed that the 386 ferret rounds fired on April 19 reached the inside of the Compound. Five of the exposure scenarios vary only in the room locations of the two CS canisters inserted by CEV-1 at 11:49:45 and 11:50:25 a.m. The possible scenarios are listed below:

- 1. Room 27 2 canisters
- 2. Room 8 2 canisters
- 3. Room 8 1 canister; Room 27 1 canister
- 4. Room 30 2 canisters
- 5. Room 27 0.5 canisters; Room 30 1.5 canisters

Based on an extensive review by Office of Special Counsel staff of eyewitness statements, Davidian statements, mensuration data, FLIR imagery and technical capabilities of the M-S canisters, scenario 5 is considered the most likely scenario. The worst case scenario for MC exposure listed above would be 2 canisters in Room 27 because of the poorer ventilation in that room (bunker). Although we have considered this scenario, we agree with Office of Special Counsel analyses, that such a scenario is virtually impossible.

We assumed that, for all 5 scenarios described above, individuals would have stayed in the same room from 6:00 a.m. until 12:20 p.m. We also applied a 6th exposure scenario, which can also be considered worst case;

6. Individuals in Room 19 from 6:00 a.m. to 8:30 a.m. who then moved to the bunker (Room 27).

This scenario was added because individuals in Room 19 would have had significant exposure to MC over the course of the morning of April 19 (see Dr. Haven's room by room predictions of MC air concentrations) and would already have COHb levels higher than in any other room prior to insertion of the canisters at 11:50 a.m. (see Figures 2 and 9 in the appendix).

The PBPK model developed by Andersen (1991) and used in our evaluation of possible MC-mediated neurotoxicity consisted of physiological parameters present in 183-LB adult males. Since children were also inside the Compound and were likely exposed to

MC, we modified the PBPK model to account for physiological parameters common to 50-LB children. Parameters modified for children are as follows:

Parameter	Adult	Child
Body weight (kg)	83	22.7
Alveolar ventilation (L/hr)	394.6472	151.3339
Cardiac output (L/hr)	330.7089	133.5594
Vmax metabolism constant (mg/hr)	137.7954	55.6497
Kf metabolism constant (hr ⁻¹)	0.5313	0.7835
RENCO (endogenous CO production) (mg/hr)	4.6233	1.8672
DL (diffusing capacity of the lung for CO) (liter/hr/mm Hg)	3.3805	1.0267

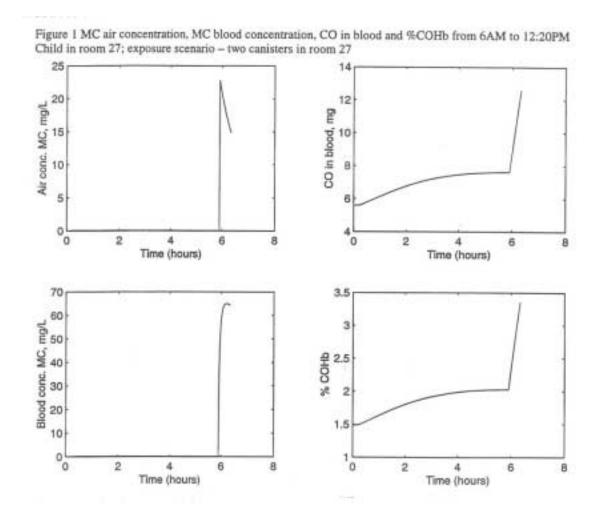
All other parameters used by Andersen (1991) were assumed to be the same for adults and children.

Model predictions were made for blood MC levels, blood CO levels and the percentage of blood heme occupied by CO (COHb) for people in every room of the Branch Davidian Complex. Heme is the component of blood, which binds oxygen and carries it to various cells and tissues of the body including the brain. These predictions span all time points between 6:00 a.m. and 12:20 p.m. and are made for both a 50-LB child and a 183-LB adult. As stated earlier, the models are based on the MC concentration estimates provided by Dr. Havens. Our review of Dr. Haven's findings satisfied us that his data are credible and appropriate for our use in applying them to our PBPK models.

Tables 1-10 (Blood MC) and 11-20 (COHb) depict some of the model results for adults and children for each of the six exposure scenarios. These tables are found in Appendix A at the end of the report. For blood MC and COHb concentrations, results are given for the time of peak concentration, the amount of MC or COHb at that peak, and the concentration of MC or COHb at 12:20 p.m.

In general, the models indicate that children would have slightly higher blood MC and COHb levels than adults from exposure to equivalent air concentrations of MC. Figures 1-14 (1-7 children, 8-14 adults) in Appendix B illustrate the time course for air concentrations of MC (from Dr. Haven's analyses), blood MC levels, blood CO

concentrations and COHb concentrations. Figure 1 is shown here as an example to illustrate the kind of information obtained from the models.



It is evident from these figures that while air MC concentrations rise and fall rapidly as a consequence of exposure to MC released from canisters or ferret rounds, blood MC concentrations are slower to decline. This difference in the rate of decline is because MC is quickly lost from the air by ventilation. However, MC must be either exhaled or degraded for it to be removed from inside the body. Also, MC is stored in fatty tissues to some extent and then slowly released into the blood, so it takes several hours for MC to be removed from the body whereas air concentrations dissipate rapidly in rooms where there is good ventilation.

The highest blood MC concentrations predicted were 65 mg/L in children in Room 27 (2 canisters in Room 27 scenario). Adult concentrations in the same scenario would be 62 mg/L. In general, for each scenario, predicted concentrations in adults are slightly lower than in children. The 2 canister in Room 27 scenario is considered by the Office of Special Counsel to be essentially an impossible scenario due to the depth of penetration by the CEV, location of the bunker, range and width of the spray emitted and other factors. The most likely scenario would be the 1.5 canister in Room 30 and

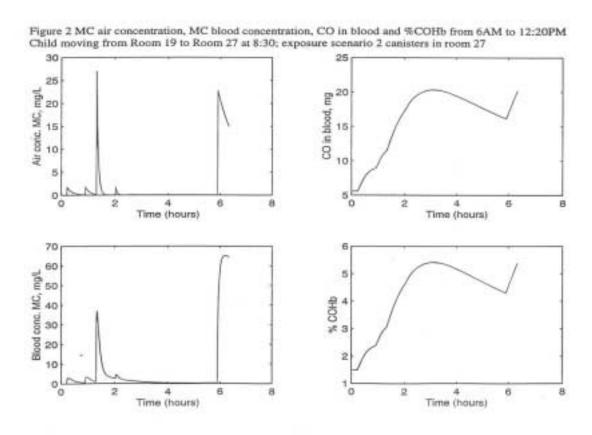
0.5 canister in Room 27 scenario. In that scenario the predicted blood concentration in Room 27 would be 16 mg/L for children. Below is a list of any predicted blood MC concentrations of greater than 20 mg/L for any of the scenarios evaluated:

Scenario	Room	Blood MC Peak		Time of Peak	Blood MC at 12:20 p.m.
		MG/L <u>Children</u>	<u>Adult</u>		
2 can Room 27	5	52	46	6:07 a.m.	0.1
	7	42	38	9:12 a.m.	0.2
	19	37	33	11:56 a.m.	0.2
	27	65	62	12:12 p.m.	61
2 can Room 8	5	52	46	6:07 a.m.	0.1
	7	41	38	9:12 a.m.	0.2
	8	26	23	11:56 a.m.	1.8
	19	37	33	11:56 a.m.	0.2
1 can Room 8	5	52	46	6.07 a.m.	0.1
1 can Room 27	7	42	38	9:12 a.m.	0.2
	19	37	33	11:56 a.m.	0.2
	27	34	32	12:16 p.m.	32
2 can Room 30	5	52	46	6:07 a.m.	0.1
	7	42	38	9:12 a.m.	0.2
	19	37	33	7:21 a.m.	0.2
1.5 can Room 30	5	52	46	6:07 a.m.	0.1
0.5 can Room 27	7	42	38	9:12 a.m.	0.2
	19	37	33	11:56 a.m.	0.2
	. •	.			Ų.

It is interesting to note that in the most likely scenario (1.5 can Room 30; 0.5 can Room 27) the highest predicted blood MC concentrations in children in Room 30 were 10 mg/L

and 16 mg/L in Room 27. The expected ventilation rate in Room 30 lessened both the magnitude and duration of MC compared to Room 27.

The Tables (1-20) also provide predictions for COHb based on each of the various exposure scenarios. COHb concentrations in the body are slow to respond to MC exposure because the inhaled MC must be metabolized to CO before the CO binds to hemoglobin and this involves multiple enzymatic steps as described earlier. The predicted time course for COHb as well as MC is illustrated in Figures 1 - 10. Figure 1 (shown earlier) depicts the predictions for 2 canisters in Room 27, which show that while MC concentrations were high from 11:50 a.m. to 12:20 p.m. COHb concentrations would only start increasing around 12:05 p.m. and still were not considered high at 12:20 p.m. Once formed COHb has a 5-hr half-life so the highest COHb levels were predicted in rooms where canisters were inserted earlier in the morning. For example, the highest predicted COHb concentration (5.4) occurred in children who were in Room 19. This peak COHb concentration would have occurred at 8:58 a.m. over an hour after the canister was inserted; the predicted COHb concentration in these same children at 12:20 p.m. was 3.9. If, however, a child moved from Room 19 to Room 27 at 8:30 a.m. and stayed there COHb levels would have been 5.3% at 12:20 p.m. These points are illustrated in Figure 2 from the appendix shown below.



within the general U.S. population COHb levels in heavy smokers range from 4-5% compared to 1.5% for non-smokers.

Relevance of predicted MC and COHb concentrations to possible health effects

There were two overarching questions posed by the OFFICE OF SPECIAL COUNSEL regarding MC effects on the Branch Davidians in the Waco Compound:

- 1. Did the MC exposures inside the Waco Compound kill any of the Branch Davidians on April 19, 1993?
- 2. Did the MC exposures inside the Compound significantly impair the judgment of the Branch Davidians such that they could not have escaped the fire on April 19, 1993?

My answer to the first question, based on the PBPK models for various exposure scenarios is, no. The highest blood MC predicted was 65 mg/L in children if 2 canisters were inserted in the bunker (Room 27) at approximately 11:50 a.m. This scenario, according to the Office of Special Counsel, is mathematically impossible. The next highest prediction was 52 mg/MC/L MC for children in Room 5 at 6:07 a.m. caused by a canister insertion at 6:05 a.m. None of the scenarios for insertion of 2 canisters around 11:50 a.m. alter this prediction.

Since the lowest blood MC measured in cases of fatal MC poisonings is 281 mg/L following several hours of exposure in an unventilated room, I conclude that MC exposures did not kill any of the Branch Davidians in Waco. This conclusion is strengthened by a number of other points:

- 1. In cases of fatal MC or CO poisonings, the blood COHb ranged from 20-70%. This compares to the highest prediction of 5.4% in the Waco Compound.
- 2. The predicted blood COHb and MC concentrations assumed that the Branch Davidians did not leave rooms that received canisters or ferret rounds. If they did leave the rooms, the predicted values would represent overestimates of the exposures experienced by the Branch Davidians.
- 3. The predicted blood COHb and MC concentrations assumed that exposures were not mitigated by the wearing of gas masks, by putting wet blankets or towels over children or any other technique attempting to limit inhalation by exposure. If exposures were mitigated in these ways the predicted values shown in this document would be overestimates.
- 4. The predicted MC and COHb blood levels assumed that all 386 ferret rounds and canister insertions found their mark. This is unlikely for the ferret rounds. If some of the ferret rounds did not reach the interior of the Compound, then the

predicted values could be overestimates. In fact, government agents have stated that many ferret rounds did not penetrate the complex.

- 5. Although rigorous analyses were used to count the number of the 386 ferret rounds fired into the building, there have been claims that as many as 400 were fired. This would represent only a 2.5% increase in MC and since each ferret round contains 33 g MC compared to the 1070 g present in each canister, the effect of an additional 14 ferret rounds would cause a less than 1% increase in the blood MC or COHb levels.
- 6. Although MC concentrations could have been very high for a short period of time, room ventilation would lead to rapid dissipation of the MC thereby preventing accumulations of lethal levels of MC and its metabolites inside the body.

My answer to the second question, "Did the MC exposures significantly impair the judgment of the Branch Davidians such that they could not have escaped the fire on April 19, 1993," is that some CNS effects likely occurred in some of the Branch Davidians inside the Compound.

The table below helps put the MC exposures of the Branch Davidians in the context of CNS effects reported in the scientific literature.

			Estimate Concen	
Effect	Concentration ppm	Exposure Concentration	MC (mg/L)	COHb (%)
Odor Threshold	100-300	On exposure		
No acute effects	100-200	Up to 7.5 hrs	1-2	3-5
Altered responses on sensory and psychomotor tests	200-800	At least 40 min	2-12	5-10
Lightheadedness	500-1000	1-2 hr	7-20	7-12
Irritation, dizziness	2300	30 min	20	10
Paresthesia	7200	10 min	40	6
Unconsciousness	8000-20,000	30 min - 4 hr	>100	>20
Waco Worst Case Sco (2 canisters in the bu)	65	5.4
Waco Most Likely Sce	enario		16	3.0

(1.5 canisters Room 30, 0.5 canisters Room 27)

Effects experienced by the Branch Davidians could include subtle alterations in CNS function such as responses to visual and auditory signals, lightheadedness, dizziness and nausea. It is important to note that many of the Branch Davidians would not have experienced those effects based on Office of Special Counsel information on which rooms were occupied during the morning of April 19.

Of greatest concern are the blood MC concentrations rather than the COHb levels since only small effects were observed in studies reported in the scientific literature at blood COHb of less than 5%. The predicted COHb levels at 12:20 p.m. or later were 5% or less in any room. In the bunker (Room 27) predicted COHb levels were 3.4% in children at 12:20 p.m. if 2 canisters (considered an impossible situation) were inserted directly inside the bunker at approximately 11:50 a.m. This number would be higher (5.3% COHb) if, as discussed earlier, a child moved from Room 19 into Room 27 prior to 11:50 a.m. (Figure 2). In contrast to the situation for blood COHb, predicted blood MC levels are clearly in the range of where CNS effects are known to occur. Although predicted concentrations should have not rendered any of the Branch Davidians unconscious, diminished responsiveness and lightheadedness likely occurred in some of the Davidians even if the blood MC predictions are overestimates because of the reasons presented earlier. It is difficult to speculate on the consequences of these effects although reaction times and ability to focus thoughts could have been compromised.

The greatest concern for a possible MC-mediated effect on the Branch Davidians appears to be the impact of MC exposure on their ability to escape the fire. Although such an effect cannot be predicted with any degree of certainty, predicted blood MC concentrations raise this possibility. The greatest concern would be for people in the bunker if any of the canisters were inserted there at approximately 11:50 a.m. The most likely scenario (0.5 canister in the bunker, 1.5 canisters in Room 30) gave predicted blood concentrations of 16 mg/L for children inside the bunker at 12:10 p.m. (Table 9 and Figure 7). Fire experts have concluded that the cafeteria fire started between 12:05 p.m. and 12:06 p.m. so it seems reasonable to assume that if someone wanted to escape the fire, they would do so a few minutes after it started or around 12:10 p.m. The data presented in Figure 7 simulate MC exposures for a child who was in Room 19 (where canisters were inserted early in the morning) then moved to the bunker at 8:30 a.m. Therefore, this Figure presents what could be considered the highest MC exposure from the most likely scenario for canister insertions at 11:50 a.m. This concentration of 16 mg/L would likely cause mild CNS effects such as diminished reactions to visual and auditory stimuli, lightheadedness and other sensations similar to those after a few drinks of an alcoholic beverage. However, it is well known that different people respond differently to alcoholic beverages and to CNS depression so it seems reasonable to assume that some Branch Davidians would be more impaired than others. However, in my opinion, most if not all of the Branch Davidians would have been able to understand the danger of the fire and been able to escape it. Unfortunately, children would be at the greatest risk for not properly understanding the danger of the fire because of their greater sensitivity to a given air concentration of MC and possible controlled information given to the children by adults inside the complex.

The greatest risk for MC influences on escaping the fire would be for the hypothetical case of a person who made an initial decision not to leave or was prevented from leaving then attempted to leave after they had suffered significant smoke inhalation effects.

An additional concern relevant to the issue of whether MC exposures could have diminished the ability of any Branch Davidians or children to escape the Branch Davidian Complex after the fire started is raised by our knowledge that MC is metabolized to CO inside the body. This is because CO is produced by fire and this CO binds to hemoglobin to form COHb that in turn causes oxygen deprivation to the brain. CO mediated oxygen deprivation is the cause of death from smoke inhalation as well as fatal CO poisonings that have occurred in parked cars with the engine running. Since some of the individuals inside the Compound had elevated COHb levels because of MC exposures they could be sensitized to smoke inhalation once the fire started and consequently would become unconscious slightly sooner than they would have if they had not already been exposed to MC. It is important to reemphasize here that this would likely not be a large effect since even in the worst case scenario, elevated COHb levels would be no worse than those occurring in smokers or less than that experienced by firefighters as illustrated below:

•	Normal COHb	1.5%
•	COHb in firefighters	3-15%
•	COHb in smokers	4-6%
•	COHb in worst case scenario in Waco at 12:20 p.m.	5.3%

♦ COHb in CO-caused greater than 20% unconsciousness

An additional concern regarding the possibility of neurological effects of the tear gas exposure of the Branch Davidians inside the Compound is based on the possible additive or synergistic effects of exposure to multiple chemicals. These chemicals include MC, CO produced from MC inside the body, CS gas and metabolites of CS. This mixture could be more potent in producing neurological effects than exposure to any of the individual agents present in the ferret founds or canisters. If this were the case, then the possibility is enhanced that some of the Branch Davidians were unable to escape the Compound after the fire started. Dr. Heinrich's report on CS gas health effects expands on this possibility. Children remain the greatest concern in this regard because they would have higher amounts of MC, CO and CS gas in their bodies than adults as a consequence of exposure to MC and CS gas from the ferret rounds and canisters.

MC Concentrations in Remains of the Branch Davidians

In order to determine if residual MC was present in the remains of the Branch Davidians, samples were analyzed by a sensitive and specific gas chromatographic-mass spectrometry detection system. It would be expected that most, if not all, of the MC present in the Branch Davidians prior to their death would be vaporized by the intense heat of the fire and therefore not present in the remains. Never the less the Office of Special Counsel concluded that MC analyses should be conducted in order to leave no stone unturned in the Waco investigation.

The samples were collected on March 15, 2000, at the Armed forces Institute of Pathology, where they were in the custody of Chief DNA Analyst Demris Lee. They had been stored for some time in a -20°C freezer wrapped in plastic bags containing smaller bags with each of the tissues from one subject and covered with a paper envelope.

The area where samples were taken was determined to be free from possible contaminating sources. Sample identifications were compared and verified with the list of samples to be taken and opened under the hood. Approximately 5 grams of tissue was collected, put into precleaned amber glass bottles, and labeled with the sample identifier. For some samples, only 3 grams of tissue was collected because it was the only tissue from a given subject. In all cases, there was twice as much sample left as was taken. Between samples, cutting tools were cleaned with ethanol provided by Ms. Lee and wiped dry with laboratory wipes. Only NIEHS personnel handled the samples.

Most of these samples were in a very compromised condition. Deterioration and prior handling was evident. Many of the smaller plastic bags had been cut and frozen tissue was simply placed in the cut bag and stored with other tissues from the same subject without being sealed in any way. The tissues looked not only burned, but also dehydrated and in many cases there was less tissue than expected from the manifest. One hundred eleven samples from 60 different individuals were taken.

At the end of the sampling effort, the labels were again verified with the list of samples to be taken and the samples were taped with plastic tape over the edges of the screw caps. The samples were placed, with plastic "bubble wrap" between layers in a styrofoam cooler. To each cooler was added an unopened bottle to serve as a Trip Blank and a bottle opened under the hood, left for approximately the amount of time it would have taken to collect one sample, then closed. This bottle served as a Field Blank. The coolers were packed with "blue ice", sealed with evidence tape, and stored overnight in a locked freezer in a laboratory with access controlled by Ms. Lee.

On March 15, 2000, the coolers were retrieved from the freezers and the evidence tape was found to be intact, indicating that there was no tampering. The coolers were placed in cardboard boxes and sealed again with evidence tape. Chain of Custody documents were signed at that time showing release of the samples to NIEHS personnel by Ms.

Lee. The coolers were then taken by plane to the contract laboratory for analysis. They were not out of sight at any time.

Once at the contract laboratory, the same Chain of Custody documents were checked against the sample labels, signed by NIEHS and laboratory personnel, and the samples were stored in a locked box in a locked freezer, in a controlled-access laboratory for later determinations of methylene chloride. Personnel conducting the chemical analyses were not informed of the origin of the samples.

MC was only detected in one sample obtained from an individual identified as 5B. This was a sample of heart tissue from Douglas Martin whose body was found in the stairwell above the auditorium and he died of smoke inhalation. The MC concentration was low in this sample. This result does not permit us to conclude that people inside the Compound were not exposed to MC because of the condition of the samples and the recognition that the fire would likely vaporize any MC present in people.

Experiments in Rats

Evaluation of the data from the MC exposure and PBPK models raised several issues relative to the effects on CNS function. These issues include the following:

- 1. What is the nature and magnitude of effects on CNS function following possible MC exposure scenarios encountered inside the compound?
- 2. Were elevated levels of CO and COHb, and subsequent oxygen deprivation inside the bodies of the Branch Davidians the cause of any CNS effects?
- 3. Did elevated levels of blood CO and COHb because of MC exposure render any of the Branch Davidians more susceptible to smoke inhalation and less able to escape the fire?
- 4. Did the direct effects of blood MC on CNS function render any of the Branch Davidians more susceptible to smoke inhalation and less able to escape the fire?
- 5. What were the CNS effects of combined exposures to MC and CS gas?

Although we will never know with absolute certainty the magnitude of CNS effects occurring inside the compound we can use predictions from the exposure and PBPK models to design experiments in rodents to provide the best possible answers to the five questions listed above. Animal models are frequently relied on to set safe exposure levels in the workplace (OSHA), general environment (EPA), consumer products (Consumer Products Safety Commission), pharmaceuticals and food additives (FDA) and around Superfund sites (ATSDR) for a wide variety of chemicals. However, rodents

are not people and from time to time rodent data will either over or underestimate human risks.

With these issues and thoughts in mind, we conducted some neurobehavioral studies in rats. Our studies are limited in scope because of the time frame required to conduct them, and analyze the data in a scientifically credible way. The only question that we have addressed in our rodent neurobehavioral studies is question three.

"Did elevated levels of blood CO and COHb because of MC exposure render any of the Branch Davidians more susceptible to CO (mimicking smoke inhalation) and less able to escape the fire?"

Although each is important, this questions specifically addresses the issue of the Branch Davidians ability to escape the fire because of elevated CO blood levels consequent from MC exposure. Failure to address the other four questions does not influence my overall conclusions presented in this report as they would serve only to provide more detail on the magnitude of CNS depression likely experienced by the Branch Davidians. The behavioral test used on the rats is called an aversion avoidance test, which will be described in more detail under Experiments 4 and 5.

Five separate experiments were conducted to validate methodologies and conduct neurobehavioral assessments in rodents. These are summarized on the following pages. A National Institutes of Health Animal Care and Use Committee, which reviews the procedures used to insure humane and ethical treatment of animals, approved animal experiments reported on in this report. All experiments were conducted according to guidelines for Good Laboratory Practices designed to minimize cases of improper or invalid experiments.

Experiment 1

Objectives: To verify blood collection method, to determine the stability of rat blood COHb, and to evaluate the variability in COHb levels between unexposed rats.

Methods: Blood (1 ml) was collected from unexposed rats (not restrained in nose tubes) by open chest cardiac puncture using blood-gas syringes. Blood samples were placed on ice for 0, 30, 60, or 120 minutes, then delivered to Duke University Medical Center (DUMC) for analysis.

Results: Two of the 20 samples clotted. This will be prevented by collecting 0.5 ml samples and mixing more thoroughly. Approximately 15-20 minutes were required to deliver samples from Research Triangle Park to DUMC.

Blood COHb was very stable under the conditions of the experiment. %COHb levels ranged from 1.1 to 1.3 over the 2-hr time period. Within group variation was acceptable. Therefore, we conclude that we can reliably quantify blood COHb levels in subsequent experiments.

<u>Time</u>	%COHb
0	1.2
30	1.3
60	1.1
120	1.1

Experiment 2

Objectives: To determine the optimal CO concentration that rats can breathe for 15 minutes and still respond in the aversion avoidance test. This CO concentration is designed to mimic CO exposure from the fire.

Methods: Male rats (10-weeks old) were exposed to 0, 6000, 4000, 2000, or 1000 ppm CO for 15 minutes. Immediately after exposure animals were briefly observed for visible CNS effects and then blood was collected for COHb determinations.

Results: <u>CNS Effects</u>: Rats exposed to 6000 ppm were very lethargic, with uncoordinated movements, and had reduced response to pain (foot pinch). Rats may still be able to respond in the aversion avoidance test after exposure to 6000 ppm. In rats exposed to 4000 ppm CNS effects (lethargy and uncoordinated movement) were present although less obvious than observed at 6000 ppm and symptoms appeared to improve within about 5 minutes after exposure. Rats exposed to 4000 ppm would likely still be able to respond in the aversion avoidance test. Exposure to 2000 or 1000 ppm had no visible CNS effects on rats.

Blood COHb Levels:

%COHb levels were significantly greater than controls in all CO exposure groups. %COHB levels at 6000 ppm were significantly lower than levels at 2000 ppm. %COHb levels at 1000 ppm were significantly lower than levels at 2000 and 4000 ppm.

CO conc. ppm:	<u>control</u>	<u>1000 ppm</u>	2000 ppm	4000 ppm	<u>6000 ppm</u>
%COHb	0.7	24.7	39.7	36.3	30.7
Based on COH	b levels ar	nd CNS effect	s, 4000 ppm	CO was selec	ted as the high
concentration to use in future 15-minute exposures (simulation of fire). 4000					
ppm CO was considered to be the optimal CO exposure concentration after					
which animals	could still r	espond in the	aversion avo	oidance test.	

Because young rats will be used in future experiments, a pilot test was conducted to determine if 4000 ppm CO would be too toxic for the younger rats. Five 4-week old rats (about 50 gm) were exposed to 4000 ppm for 15 minutes and then evaluated for CNS effects. Exposure to 4000 ppm appeared to have greater CNS effects (lethargy, uncoordinated movements) on young rats than on older rats. The severity of the effects appeared similar to that observed in 10-week old rats exposed to 6000 ppm. Rats seemed to recover slightly after about 5-10 minutes after exposure.

Experiment 3

Objective: (1) To determine the CO exposure concentration that results in approximately 5% COHb in rats after exposure for 2 hours (mimics % COHb predicted to occur by PBPK models in worst case scenarios in the Branch Davidian complex; (2) To evaluate the CNS effects of sequential exposure to 50 ppm/2 hr (mimicking COHb levels from MC exposure) + 4000 ppm/15 minutes (mimicking fire).

Methods: Based upon computer simulations (PBPK models), exposure of rats to about 50 ppm CO for 2 hr was predicted to result in about 5% COHb; therefore 50 ppm was the initial exposure concentration. If 50 ppm CO did not produce approximately 5% COHb then additional exposures were to be conducted at 60 or 40 ppm CO. Rats were exposed to 50 ppm CO for up to 2 hours. Blood was collected from 5 rats after exposure for 15, 30, 60 and 120 minutes and analyzed for %COHb.

Results: Exposure to 50 ppm CO resulted in approximately 5% COHb after exposure for 60 minutes. Blood COHb remained at about 5% throughout the remainder of the 2-hour exposure.

An additional exposure to 60 ppm CO was conducted to see if a %5 COHb level could be attained more quickly. However, the %COHb continued to increase throughout the 2-hr exposure to about 6%. The 50 ppm exposure concentration produced the best results.

A pilot study was conducted to ensure that the combination of 50 ppm for 2 hours followed by 4000 ppm for 15 minutes would not render the rats unable to respond in the avoidance aversion test. Five rats were exposed to the combination exposure and observed for adverse effects. The animals were lethargic with uncoordinated movement but did not appear to be more affected than the rats exposed only to 4000 ppm for 15 minutes (Expt 2). The mean %COHb in rats exposed to 50 ppm + 4000 ppm was $32 \pm 6\%$.

The results generated in Experiments 1-3 were used to establish the final design for the neurobehavioral assessments. A description of the procedures used to assess avoidance/escape abilities of rats is presented next.

Avoidance/Escape Learning Procedures for Rats Used in Experiments 4 and 5

The two-way shuttle box procedure utilizes the aversive nature of either a mild shock or a sharp blast of air as a negative reinforcer to evalute learning and memory functioning. This procedure does not depend upon performance of a food motivated response thus, food or water deprivation is not required. Acquisition of discriminated avoidance response is measured in a shuttle box comprised of two compartments with an access to each chamber allowed through a guillotine doorway. The chambers have a floor of stainless steel grids approximately 11/16" apart for rats and 1/2" for mice to which a 0.4mA electric foot shock is applied via a computer controlled shocker scrambler. Chambers have low level house lighting, a cue light in each chamber and a speaker for delivery of tonal cue. Equipment available at NIEHS was obtained from San Diego Instruments, Inc.

Animals were acclimated to handling prior to testing.

Each session began by placing rat into one compartment, closing the chamber door and opening the guillotine door between the two chambers. The computercontrolled session was started and allowed for automatic activation of stimuli and recording of responses.

Animals were allowed a 240-second habituation to the chambers. During this period, the activity of each animal was monitored by investigator observation. Following this warm-up period, the training trials are initiated automatically by the computer program.

Each trail consisted of the presentation of a paired light and tone conditioned stimulus (CS) in the compartment containing the animal. The animal had 8 seconds from the initiation of the light/tone until delivery of the shock. An avoidance response was recorded if the animal exited the side where the light and tone are being delivered with this 8-second interval. If the animal failed to leave the side having the CS within 8 seconds an electric foot shock (0.4mA) is applied to the grids of the floor. Moving to the safe (non-shock) side was recorded as an escape response. If the animal does not make an appropriate response to remove itself from the shock within the 10 seconds shock delivery period, the shock was terminated and the response recorded as an escape loss. Following avoidance response (latency less than 8 seconds), the light-tone cues and/or shock were terminated and a variable inter-trial interval (ITI) 15 seconds initiated. Responses (crosses between chambers) during the ITI were recorded. Latency to make an avoidance response or escape response was recorded.

All animals were given 60 training trials for a total time of approximately 30 minutes per session. Within 3 days of the initial training session, and 24 hours prior to the experimental exposure, animals received a short (30 trials) session to verify performance and retention of the learned task. Immediately following exposure, animals were placed in the shuttle box apparatus and the session started. Each session included a 240-second habituation period followed by 10 trials. During the habituation period animals were observed for activity level and general behavior. Behavior during the testing trials was monitored and recorded.

Experiments 4 and 5

Objectives: (1) Experiment 4: To evaluate the effects of sequential CO exposure 50 ppm/2 hours (mimicking CO exposure from MC metabolism) followed by 4000 ppm/15 min. (mimicking CO exposure from fire) on active avoidance performance. (2) Experiment 5: To evaluate the effects of 15 min. of 4000 ppm CO exposure alone on rats' active avoidance performance.

Methods: Ten (10) ten-week old Fisher 344 rats were trained, verified, and tested in the shuttle box procedure per CO group, and for the control group in experiment 4. In experiment 5, 4 control animals were tested. See attached shuttle box protocol.

Results: Relative to air-exposed control rats, those exposed to CO, by either protocol, were lethargic, with uncoordinated movements. All animals had achieved a reliable escape or avoidance response by their verification trial. CO exposed animals largely lost the escape response, or decreased from an avoidance to an escape response. In most cases, CO exposed animals' sessions were terminated after 10 trails because the animals were demonstrating a "shut down" response with complete escape loss. They seemed unable to locomote well, although they were clearly anticipating and reacting to the shock. However, immediately on return to the home cage, all CO exposed animals alerted, increased arousal level, and began moving about the cage. Hind limb strength and extensor reflexes were weaker than air-exposed controls (approximately 15 min. after end of exposure).

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Exp	CIII		ΙΙL 4

	Air Controls	50/4000 ppm CO Exposed
Escape latencies (sec)	9.3	10.8
Avoidance latencies (sec	2.6	5.3
Number of escapes	4.4	3.7
Number of Avoids	5.4	1.3
Number of escape losses	0.2	5.0

Experiment 5_

	Air Controls	Air/4000 ppm CO Exposed
Escape latencies (sec)	8.6	11.9
Avoidance latencies (sec	3.3	3.3
Number of escapes	1.0	1.5
Number of Avoids	9.0	0.0
Number of escape losses	0.0	8.5

The most important comparison relevant to the ability of the Branch Davidians to escape the fire is the number of escape losses. All animals, not exposed to CO had essentially no escape losses and therefore they exhibited full ability to escape or avoid the electric shock. This ability to escape the electric shock was diminished to 15% of normal when rats were exposed to 4000-ppm CO alone (mimicking fire without preexposure to MC). However, when rats were exposed to 50 ppm for two hours (producing 5% COHb) followed by 4000 ppm CO, escape reactions were diminished to only 50% of normal.

Therefore, results from the rat experiments do not support the possibility that CO produced from MC exposure rendered the Branch Davidians, including children, less able to escape the fire. In fact, pre-exposure to low levels of CO either improved or did not change escape/avoidance reactions in rats when they were exposed to high levels of CO (mimicking CO from fire). However, it is important to remember that MC has direct effects on CNS function independent of its metabolism to CO. This would be the case posed in question 4, which was not addressed in our rodent neurobehavioral studies. Therefore, no firm conclusions can be drawn from the rodent studies.

General Conclusions

This report is based on a rigorous and thorough evaluation of the scientific literature concerning health effects of MC coupled with state-of-the-art simulation modeling to predict the possible effects of MC on the Branch Davidians at the Waco Complex on April 19, 1993. In addition, experiments were conducted in rats to evaluate some effects of MC on the Central Nervous System (CNS).

In my opinion, MC exposures did not kill any of the Branch Davidians. However, it appears likely that some Branch Davidians could have experienced CNS depression because of MC exposures. This could have caused decreased response to visual and auditory stimuli, lightheadedness and irritation. It also appears possible that the CNS depression, coupled with decreased oxygen carrying capacity of red blood cells (because of degradation of MC to carbon monoxide inside the body) could have slightly diminished the ability of the Branch Davidians to escape the fire. In my opinion, Branch Davidians would have been able to escape the fire if they decided to right after the fire started. The greatest

risk for MC influences on escaping the fire would be for the hypothetical case of a person who made an initial decision not to leave or was prevented from leaving then attempted to leave after they had suffered very significant smoke inhalation effects.

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Appendix A

Results from Methylene Chloride and Carbon Monoxide calculations

Table 1 Blood MC (mg/L) in Adults Exposure scenario – 2 canisters in room 30

Room	Time of peak	Blood MC at peak	Blood MC at 12:20
H1	6:10	6.72	0.03
Rm1	6:04	9.39	0.03
Rm2	9:17	0.40	0.02
Rm3	9:56	0.10	0.04
Rm4	9:20	0.28	0.07
Rm5	6:07	46.43	0.12
Rm6	9:09	16.92	0.03
Rm7	9:12	37.85	0.22
H8	6:12	0.89	0.01
Rm8	6:15	0.82	0.01
Rm9	6:39	0.18	0.03
Rm10	6:35	0.18	0.02
Rm11	6:17	0.37	0.02
Rm12	7:22	2.70	0.07
Rm13	11:14	1.29	0.01
Rm14	7:15	2.60	0.06
Rm15	7:13	2.80	0.08
FO	11:55	1.30	0.01
SFO12	6:11	1.07	0.01
Rm16	6:37	0.12	0.03
Rm17	8:19	0.59	0.15
Rm18	12:05	14.33	0.24
Rm19	7:21	33.36	0.14
Rm20	7:35	3.60	0.02
Rm21	12:20	0.00	0.00
Rm22	6:14	0.40	0.00
Rm23	6:16	0.14	0.00
Rm24	6:16	2.18	0.01
Rm26	6:12	2.37	0.06
Rm27	12:20	0.36	0.36
Rm29	11:53	2.88	0.28
Rm30	11:50	12.13	0.21
H31	7:55	2.44	0.01
Rm31	6:23	1.66	0.00
Rm32	7:53	11.67	0.01
Rm33	7:55	11.69	0.01
Rm34	7:55	0.95	0.00
Rm35	11:37	0.76	0.00
Rm36	6:58	2.96	0.02
Rm37	7:56	2.03	0.01
Rm38	7:56	2.02	0.01
Rm39	7:56	2.02	0.01
Rm40	7:56	2.16	0.01
H40	6:12	1.82	0.01
SCA12	6:12	1.81	0.01
H41	6:09	2.36	0.01
Rm41	11:28	2.55	0.03
*******	11.20	2.55	0.05

Rm42	11:25	1.81	0.01
Rm43	11:23	1.58	0.02
Rm44	11:21	1.45	0.02
Rm45	11:19	1.37	0.01
Rm46	11:17	1.31	0.01
Rm47	7:39	0.17	0.09
H48	6:09	6.68	0.01
Rm48	11:05	0.75	0.00
Rm49	11:03	0.74	0.00
Rm50	6:08	8.70	0.00
Rm51	6:51	1.23	0.01
H53	6:09	2.34	0.01
Rm52	6:11	1.29	0.01
STO24	6:09	2.13	0.00
Rm53	6:09	2.17	0.01
Rm54	7:35	0.84	0.01
SST12	6:09	1.20	0.00
Rm55	6:07	3.64	0.01
Rm56	6:08	2.87	0.01
SLN23	7:55	2.38	0.01
Rm57	7:56	1.97	0.01
SLS23	6:09	1.06	0.00
Rm58	6:13	1.06	0.00
Rm59	6:10	1.95	0.00
Rm60	6:10	1.31	0.00

Table 2 Blood MC (mg/L) in Adults Exposure scenario – 2 canisters in room 8

Doom	Time of peak	Blood MC at peak	Blood MC at 12:20
Room	Time of peak		
H1	6:07	5.06	0.02
Rm1	6:04	9.39	0.03
Rm2	6:19	0.25	0.03
Rm3	9:22	0.06	0.04
Rm4	6:24	0.13	0.04
Rm5	6:07	46.47	0.12
Rm6	9:09	16.97	0.04
Rm7	9:12	38.18	0.23
H8	11:55	0.80	0.01
Rm8	11:56	23.30	1.48
Rm9	12:04	0.06	0.03
Rm10	11:59	0.09	0.02
Rm11	11:58	0.10	0.02
Rm12	7:22	2.81	0.08
Rm13	11:14	1.29	0.01
Rm14	7:16	2.69	0.07
Rm15	7:13	2.82	0.08
FO	11:55	1.09	0.01
SFO12	11:55	0.84	0.01
Rm16	7:42	0.06	0.03
Rm17	8:20	0.62	0.20
Rm18	12:05	14.28	0.24
Rm19	7:21	33.13	0.14
Rm20	7:35	3.51	0.01
Rm21	12:20	0.00	0.00
Rm22	6:13	0.40	0.00
Rm23	6:16	0.14	0.00
Rm24	6:16	2.18	0.01
Rm26	6:12	2.42	0.08
Rm27	7:53	0.16	0.14
Rm29	12:11	1.47	1.26
Rm30	12:03	2.04	0.92
H31	7:55	2.52	0.01
Rm31	6:23	1.73	0.00
Rm32	7:53	11.34	0.01
Rm33	7:55	11.46	0.01
Rm34	7:55	0.93	0.00
Rm35	11:37	0.74	0.00
Rm36	6:58	2.66	0.01
Rm37	7:56	2.09	0.01
Rm38	7:56	2.09	0.01
Rm39	7:56	2.08	0.01
Rm40	7:56	2.23	0.01
H40	6:12	1.60	0.01
SCA12	6:12	1.65	0.01
H41	6:09	1.97	0.01
Rm41	11:28	2.21	0.02

Rm42 11:25 1.73 0.01 Rm43 11:23 1.53 0.01 Rm44 11:21 1.42 0.02 Rm45 11:19 1.34 0.01 Rm46 11:17 1.28 0.01 Rm47 7:41 0.10 0.07 H48 6:09 6.55 0.01 Rm48 11:05 0.74 0.00 Rm49 11:03 0.73 0.00 Rm50 6:08 8.65 0.00 Rm51 6:51 1.12 0.00 H53 6:09 1.95 0.01 Rm52 6:11 1.04 0.01 STO24 6:09 1.74 0.00 Rm53 6:09 1.78 0.01 Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00				
Rm44 11:21 1.42 0.02 Rm45 11:19 1.34 0.01 Rm46 11:17 1.28 0.01 Rm47 7:41 0.10 0.07 H48 6:09 6.55 0.01 Rm48 11:05 0.74 0.00 Rm49 11:03 0.73 0.00 Rm50 6:08 8.65 0.00 Rm51 6:51 1.12 0.00 Rm52 6:11 1.04 0.01 STO24 6:09 1.74 0.00 Rm53 6:09 1.78 0.01 Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00 <td>Rm42</td> <td>11:25</td> <td>1.73</td> <td>0.01</td>	Rm42	11:25	1.73	0.01
Rm45 11:19 1.34 0.01 Rm46 11:17 1.28 0.01 Rm47 7:41 0.10 0.07 H48 6:09 6.55 0.01 Rm48 11:05 0.74 0.00 Rm49 11:03 0.73 0.00 Rm50 6:08 8.65 0.00 Rm51 6:51 1.12 0.00 H53 6:09 1.95 0.01 Rm52 6:11 1.04 0.01 STO24 6:09 1.74 0.00 Rm53 6:09 1.78 0.01 Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00 <td>Rm43</td> <td>11:23</td> <td>1.53</td> <td>0.01</td>	Rm43	11:23	1.53	0.01
Rm46 11:17 1.28 0.01 Rm47 7:41 0.10 0.07 H48 6:09 6.55 0.01 Rm48 11:05 0.74 0.00 Rm49 11:03 0.73 0.00 Rm50 6:08 8.65 0.00 Rm51 6:51 1.12 0.00 H53 6:09 1.95 0.01 Rm52 6:11 1.04 0.01 STO24 6:09 1.74 0.00 Rm53 6:09 1.78 0.01 Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	Rm44	11:21	1.42	0.02
Rm47 7:41 0.10 0.07 H48 6:09 6.55 0.01 Rm48 11:05 0.74 0.00 Rm49 11:03 0.73 0.00 Rm50 6:08 8.65 0.00 Rm51 6:51 1.12 0.00 H53 6:09 1.95 0.01 Rm52 6:11 1.04 0.01 STO24 6:09 1.74 0.00 Rm53 6:09 1.78 0.01 Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	Rm45	11:19	1.34	0.01
H48 6:09 6.55 0.01 Rm48 11:05 0.74 0.00 Rm49 11:03 0.73 0.00 Rm50 6:08 8.65 0.00 Rm51 6:51 1.12 0.00 H53 6:09 1.95 0.01 Rm52 6:11 1.04 0.01 STO24 6:09 1.74 0.00 Rm53 6:09 1.78 0.01 Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	Rm46	11:17	1.28	0.01
Rm48 11:05 0.74 0.00 Rm49 11:03 0.73 0.00 Rm50 6:08 8.65 0.00 Rm51 6:51 1.12 0.00 H53 6:09 1.95 0.01 Rm52 6:11 1.04 0.01 STO24 6:09 1.74 0.00 Rm53 6:09 1.78 0.01 Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	Rm47	7:41	0.10	0.07
Rm49 11:03 0.73 0.00 Rm50 6:08 8.65 0.00 Rm51 6:51 1.12 0.00 H53 6:09 1.95 0.01 Rm52 6:11 1.04 0.01 STO24 6:09 1.74 0.00 Rm53 6:09 1.78 0.01 Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	H48	6:09	6.55	0.01
Rm50 6:08 8.65 0.00 Rm51 6:51 1.12 0.00 H53 6:09 1.95 0.01 Rm52 6:11 1.04 0.01 STO24 6:09 1.74 0.00 Rm53 6:09 1.78 0.01 Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	Rm48	11:05	0.74	0.00
Rm51 6:51 1.12 0.00 H53 6:09 1.95 0.01 Rm52 6:11 1.04 0.01 STO24 6:09 1.74 0.00 Rm53 6:09 1.78 0.01 Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	Rm49	11:03	0.73	0.00
H53 6:09 1.95 0.01 Rm52 6:11 1.04 0.01 STO24 6:09 1.74 0.00 Rm53 6:09 1.78 0.01 Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	Rm50	6:08	8.65	0.00
Rm52 6:11 1.04 0.01 STO24 6:09 1.74 0.00 Rm53 6:09 1.78 0.01 Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	Rm51	6:51	1.12	0.00
STO24 6:09 1.74 0.00 Rm53 6:09 1.78 0.01 Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	H53	6:09	1.95	0.01
Rm53 6:09 1.78 0.01 Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	Rm52	6:11	1.04	0.01
Rm54 7:35 0.84 0.00 SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	STO24	6:09	1.74	0.00
SST12 6:09 1.20 0.00 Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	Rm53	6:09	1.78	0.01
Rm55 6:07 3.64 0.00 Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	Rm54	7:35	0.84	0.00
Rm56 6:08 2.87 0.00 SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	SST12	6:09	1.20	0.00
SLN23 7:55 2.47 0.01 Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	Rm55	6:07	3.64	0.00
Rm57 7:56 2.03 0.01 SLS23 6:09 1.04 0.00	Rm56	6:08	2.87	0.00
SLS23 6:09 1.04 0.00	SLN23	7:55	2.47	0.01
	Rm57	7:56	2.03	0.01
Rm58 6:13 1.06 0.00	SLS23	6:09	1.04	0.00
	Rm58	6:13	1.06	0.00
Rm59 6:10 1.90 0.00	Rm59	6:10	1.90	0.00
Rm60 6:10 1.09 0.00	Rm60	6:10	1.09	0.00

Table 3
Blood MC (mg/L) in Adults
Exposure scenario – 1 canister in room 8, 1 in room 27

Room	Time of peak	Blood MC at peak	Blood MC at 12:20
H1	6:07	5.06	0.02
Rm1	6:04	9.39	0.03
Rm2	6:19	0.25	0.03
Rm3	9:22	0.06	0.04
Rm4	6:24	0.13	0.04
Rm5	6:07	46.47	0.12
Rm6	9:09	16.97	0.04
Rm7	9:12	38.18	0.23
Н8	11:55	0.80	0.01
Rm8	11:56	11.64	0.62
Rm9	12:04	0.06	0.03
Rm10	11:59	0.09	0.02
Rm11	11:58	0.10	0.02
Rm12	7:22	2.81	0.08
Rm13	11:14	1.29	0.01
Rm14	7:16	2.69	0.07
Rm15	7:13	2.82	0.08
FO	11:55	1.09	0.01
SFO12	11:55	0.84	0.01
Rm16	7:42	0.06	0.03
Rm17	8:20	0.62	0.20
Rm18	12:05	14.28	0.24
Rm19	7:21	33.13	0.14
Rm20	7:35	3.51	0.01
Rm21	12:20	0.00	0.00
Rm22	6:13	0.40	0.00
Rm23	6:16	0.14	0.00
Rm24	6:16	2.18	0.01
Rm26	6:12	2.42	0.08
Rm27	12:16	32.38	32.31
Rm29	12:11	0.77	0.66
Rm30	12:02	1.05	0.48
H31	7:55	2.52	0.01
Rm31	6:23	1.73	0.00
Rm32	7:53	11.34	0.01
Rm33	7:55	11.46	0.01
Rm34	7:55	0.93	0.00
Rm35	11:37	0.74	0.00
Rm36	6:58	2.66	0.01
Rm37	7:56	2.09	0.01
Rm38	7:56	2.09	0.01
Rm39	7:56	2.08	0.01
Rm40	7:56	2.23	0.01
H40	6:12	1.60	0.01
SCA12	6:12	1.65	0.01

H41	6:09	1.97	0.01
Rm41	11:28	2.21	0.02
Rm42	11:25	1.73	0.01
Rm43	11:23	1.53	0.01
Rm44	11:21	1.42	0.02
Rm45	11:19	1.34	0.01
Rm46	11:17	1.28	0.01
Rm47	7:41	0.10	0.07
H48	6:09	6.55	0.01
Rm48	11:05	0.74	0.00
Rm49	11:03	0.73	0.00
Rm50	6:08	8.65	0.00
Rm51	6:51	1.12	0.00
H53	6:09	1.95	0.01
Rm52	6:11	1.04	0.01
STO24	6:09	1.74	0.00
Rm53	6:09	1.78	0.01
Rm54	7:35	0.84	0.00
SST12	6:09	1.20	0.00
Rm55	6:07	3.64	0.00
Rm56	6:08	2.87	0.00
SLN23	7:55	2.47	0.01
Rm57	7:56	2.03	0.01
SLS23	6:09	1.04	0.00
Rm58	6:13	1.06	0.00
Rm59	6:10	1.90	0.00
Rm60	6:10	1.09	0.00

Table 4
Blood MC (mg/L) in Adults
Exposure scenario – 2 canisters in room 27

Room	Time of peak	Blood MC at peak	Blood MC at 12:20
H1	6:07	5.06	0.02
Rm1	6:04	9.39	0.03
Rm2	6:19	0.25	0.03
Rm3	9:22	0.06	0.04
Rm4	6:24	0.13	0.04
Rm5	6:07	46.47	0.12
Rm6	9:09	16.97	0.04
Rm7	9:12	38.18	0.23
Н8	11:55	0.80	0.01
Rm8	11:57	0.17	0.01
Rm9	12:04	0.06	0.03
Rm10	11:59	0.09	0.02
Rm11	11:58	0.10	0.02
Rm12	7:22	2.81	0.08
Rm13	11:14	1.29	0.01
Rm14	7:16	2.69	0.07
Rm15	7:13	2.82	0.08
FO	11:55	1.09	0.01
SFO12	11:55	0.84	0.01
Rm16	7:42	0.06	0.03
Rm17	8:20	0.62	0.20
Rm18	12:05	14.28	0.24
Rm19	7:21	33.13	0.14
Rm20	7:35	3.51	0.01
Rm21	12:20	0.00	0.00
Rm22	6:13	0.40	0.00
Rm23	6:16	0.14	0.00
Rm24	6:16	2.18	0.01
Rm26	6:12	2.42	0.10
Rm27	12:12	61.77	60.59
Rm29	6:27	0.64	0.11
Rm30	6:18	0.86	0.10
H31	7:55	2.52	0.01
Rm31	6:23	1.73	0.00
Rm32	7:53	11.34	0.01
Rm33	7:55	11.46	0.01
Rm34	7:55	0.93	0.00
Rm35	11:37	0.74	0.00
Rm36	6:58	2.66	0.01
Rm37	7:56	2.09	0.01
Rm38	7:56	2.09	0.01
Rm39	7:56	2.08	0.01
Rm40	7:56	2.23	0.01

H40	6:12	1.60	0.01
SCA12	6:12	1.65	0.01
H41	6:09	1.97	0.01
Rm41	11:28	2.21	0.02
Rm42	11:25	1.73	0.01
Rm43	11:23	1.53	0.01
Rm44	11:21	1.42	0.02
Rm45	11:19	1.34	0.01
Rm46	11:17	1.28	0.01
Rm47	7:41	0.10	0.07
H48	6:09	6.55	0.01
Rm48	11:05	0.74	0.00
Rm49	11:03	0.73	0.00
Rm50	6:08	8.65	0.00
Rm51	6:51	1.12	0.00
H53	6:09	1.95	0.01
Rm52	6:11	1.04	0.01
STO24	6:09	1.74	0.00
Rm53	6:09	1.78	0.01
Rm54	7:35	0.84	0.00
SST12	6:09	1.20	0.00
Rm55	6:07	3.64	0.00
Rm56	6:08	2.87	0.00
SLN23	7:55	2.47	0.01
Rm57	7:56	2.03	0.01
SLS23	6:09	1.04	0.00
Rm58	6:13	1.06	0.00
Rm59	6:10	1.90	0.00
Rm60	6:10	1.09	0.00

Table 5
Blood MC (mg/L) in Adults
Exposure scenario – 1.5 canisters in room 30, 0.5 in room 27

Room	Time of peak	Blood MC at peak	Blood MC at 12:20
H1	6:07	6.00	0.03
Rm1	6:04	9.39	0.02
Rm2	9:17	0.36	0.04
Rm3	9:41	0.09	0.07
Rm4	9:20	0.24	0.06
Rm5	6:07	46.44	0.12
Rm6	9:09	16.94	0.03
Rm7	9:12	37.93	0.22
H8	11:55	0.67	0.01
Rm8	6:15	0.62	0.01
Rm9	6:39	0.14	0.03
Rm10	6:34	0.14	0.02
Rm11	6:18	0.28	0.02
Rm12	7:22	2.73	0.07
Rm13	11:14	1.29	0.01
Rm14	7:15	2.62	0.06
Rm15	7:13	2.81	0.08
FO	11:55	1.25	0.01
SFO12	11:55	0.98	0.01
Rm16	6:37	0.10	0.03
Rm17	8:19	0.60	0.17
Rm18	12:05	14.32	0.24
Rm19	7:21	33.29	0.14
Rm20	7:35	3.58	0.01
Rm21	12:20	0.00	0.00
Rm22	6:14	0.40	0.00
Rm23	6:16	0.14	0.00
Rm24	6:16	2.18	0.01
Rm26	6:12	2.38	0.07
Rm27	12:10	15.07	14.67
Rm29	11:53	2.16	0.23
Rm30	11:50	9.10	0.18
H31	7:55	2.46	0.01
Rm31	6:23	1.67	0.00
Rm32	7:53	11.59	0.01
Rm33	7:55	11.64	0.01
Rm34	7:55	0.94	0.00
Rm35	11:37	0.75	0.00
Rm36	6:58	2.88	0.02
Rm37	7:56	2.05	0.01
Rm38	7:56	2.04	0.01
Rm39	7:56	2.04	0.01

Rm40	7:56	2.18	0.01
H40	6:12	1.76	0.01
SCA12	6:12	1.77	0.01
H41	6:09	2.26	0.01
Rm41	11:28	2.46	0.03
Rm42	11:25	1.79	0.01
Rm43	11:23	1.57	0.02
Rm44	11:21	1.44	0.02
Rm45	11:19	1.36	0.01
Rm46	11:17	1.30	0.01
Rm47	7:40	0.15	0.09
H48	6:09	6.65	0.01
Rm48	11:05	0.74	0.00
Rm49	11:03	0.74	0.00
Rm50	6:08	8.69	0.00
Rm51	6:51	1.20	0.01
H53	6:09	2.24	0.01
Rm52	6:11	1.23	0.01
STO24	6:09	2.03	0.00
Rm53	6:09	2.07	0.01
Rm54	7:35	0.84	0.01
SST12	6:09	1.20	0.00
Rm55	6:07	3.64	0.01
Rm56	6:08	2.87	0.01
SLN23	7:55	2.40	0.01
Rm57	7:56	1.98	0.01
SLS23	6:09	1.05	0.00
Rm58	6:13	1.06	0.00
Rm59	6:10	1.94	0.00
Rm60	6:10	1.25	0.00

Table 6 Blood MC (mg/L) in Children Exposure scenario – 2 canisters in room 30

Room	Time of peak	Blood MC at peak	Blood MC at 12:20
H1	6:10	7.11	0.03
Rm1	6:04	10.23	0.02
Rm2	9:17	0.40	0.04
Rm3	9:55	0.10	0.08
Rm4	9:20	0.28	0.07
Rm5	6:07	51.59	0.13
Rm6	9:09	19.23	0.03
Rm7	9:12	41.43	0.17
Н8	6:12	0.94	0.01
Rm8	6:15	0.84	0.01
Rm9	6:40	0.18	0.03
Rm10	6:34	0.18	0.02
Rm11	6:16	0.38	0.02
Rm12	7:21	2.94	0.07
Rm13	11:14	1.42	0.01
Rm14	7:15	2.83	0.06
Rm15	7:12	3.04	0.08
FO	11:55	1.50	0.01
SFO12	11:55	1.19	0.01
Rm16	6:36	0.12	0.03
Rm17	7:07	0.59	0.15
Rm18	12:05	16.28	0.28
Rm19	7:21	37.02	0.14
Rm20	7:35	3.89	0.02
Rm21	12:20	0.00	0.00
Rm22	6:13	0.43	0.00
Rm23	6:16	0.14	0.00
Rm24	6:16	2.31	0.01
Rm26	6:12	2.47	0.06
Rm27	12:20	0.36	0.36
Rm29	11:53	3.09	0.32
Rm30	11:50	13.63	0.26
H31	7:55	2.71	0.01
Rm31	6:23	1.85	0.00
Rm32	7:53	13.46	0.01
Rm33	7:55	13.51	0.01
Rm34	7:55	1.09	0.01
Rm35	11:37	0.87	0.00
Rm36	6:58	3.22	0.02
Rm37	6:26	2.26	0.01
Rm38	7:56	2.20	0.01
Rm39	7:56	2.19	0.01
Rm40	7:56	2.35	0.01
H40	6:12	1.93	0.01
SCA12	6:12	1.94	0.01
H41	6:09	2.58	0.01
Rm41	11:28	2.79	0.03
Rm42	11:25	2.04	0.01

Rm43	11:23	1.80	0.02
Rm44	11:21	1.66	0.02
Rm45	11:19	1.56	0.01
Rm46	11:17	1.50	0.01
Rm47	7:39	0.17	0.09
H48	6:09	7.39	0.01
Rm48	11:05	0.84	0.00
Rm49	11:03	0.83	0.00
Rm50	6:08	9.97	0.00
Rm51	6:51	1.34	0.01
H53	6:09	2.56	0.02
Rm52	6:11	1.45	0.01
STO24	6:09	2.32	0.00
Rm53	6:09	2.36	0.01
Rm54	7:35	0.91	0.01
SST12	6:09	1.31	0.00
Rm55	6:07	4.12	0.01
Rm56	6:08	3.13	0.01
SLN23	7:55	2.64	0.01
Rm57	7:56	2.14	0.01
SLS23	6:09	1.15	0.00
Rm58	6:12	1.17	0.00
Rm59	6:10	2.12	0.00
Rm60	6:10	1.41	0.00

Table 7
Blood MC (mg/L) in Children
Exposure scenario – 2 canisters in room 8

Room	Time of peak	Blood MC at peak	Blood MC at 12:20
H1	6:07	5.46	0.02
Rm1	6:04	10.23	0.03
Rm2	6:19	0.25	0.03
Rm3	9:22	0.06	0.04
Rm4	6:24	0.13	0.04
Rm5	6:07	51.64	0.13
Rm6	9:09	19.27	0.03
Rm7	9:12	41.84	0.17
Н8	11:55	0.91	0.01
Rm8	11:56	25.82	1.77
Rm9	12:03	0.06	0.03
Rm10	11:58	0.09	0.02
Rm11	11:57	0.11	0.02
Rm12	7:21	3.05	0.07
Rm13	11:14	1.42	0.01
Rm14	7:15	2.93	0.06
Rm15	7:12	3.06	0.07
FO	11:55	1.27	0.01
SFO12	11:55	0.97	0.01
Rm16	7:41	0.07	0.03
Rm17	8:19	0.62	0.20
Rm18	12:05	16.23	0.28
Rm19	7:21	36.77	0.13
Rm20	7:35	3.80	0.01
Rm21	12:20	0.00	0.00
Rm22	6:13	0.43	0.00
Rm23	6:15	0.14	0.00
Rm24	6:16	2.31	0.01
Rm26	6:12	2.50	0.09
Rm27	7:28	0.17	0.14
Rm29	12:11	1.49	1.28
Rm30	12:02	2.09	0.95
H31	7:55	2.81	0.01
Rm31	6:23	1.92	0.00
Rm32	7:53	13.11	0.01
Rm33	7:55	13.23	0.01
Rm34	7:55	1.06	0.00
Rm35	11:37	0.85	0.00
Rm36	6:58	2.88	0.02
Rm37	7:56	2.27	0.01
Rm38	7:56	2.26	0.01
Rm39	7:56	2.26	0.01
Rm40	7:56	2.42	0.01
H40	6:09	1.72	0.01
SCA12	6:12	1.77	0.01
H41	6:09	2.15	0.01
Rm41	11:27	2.45	0.02
Rm42	11:25	1.95	0.01

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Rm43	11:23	1.74	0.02
Rm44	11:21	1.62	0.02
Rm45	11:19	1.53	0.01
Rm46	11:17	1.47	0.01
Rm47	7:40	0.10	0.06
H48	6:09	7.24	0.01
Rm48	11:05	0.83	0.00
Rm49	11:03	0.82	0.00
Rm50	6:08	9.91	0.00
Rm51	6:51	1.22	0.00
H53	6:09	2.12	0.01
Rm52	6:11	1.18	0.01
STO24	6:09	1.89	0.00
Rm53	6:09	1.93	0.01
Rm54	7:35	0.91	0.00
SST12	6:09	1.31	0.00
Rm55	6:07	4.12	0.00
Rm56	6:08	3.12	0.00
SLN23	7:55	2.74	0.01
Rm57	7:56	2.20	0.01
SLS23	6:09	1.13	0.00
Rm58	6:13	1.17	0.00
Rm59	6:10	2.07	0.00
Rm60	6:10	1.18	0.00

Table 8
Blood MC (mg/L) in Children
Exposure scenario – 1 canister in room 8, 1 in room 27

Room	Time of peak	Blood MC at peak	Blood MC at 12:20
H1	6:07	5.46	0.02
Rm1	6:04	10.23	0.03
Rm2	6:19	0.25	0.03
Rm3	9:22	0.06	0.04
Rm4	6:24	0.13	0.04
Rm5	6:07	51.64	0.13
Rm6	9:09	19.27	0.03
Rm7	9:12	41.84	0.17
H8	11:55	0.91	0.01
Rm8	11:56	12.86	0.77
Rm9	12:03	0.06	0.03
Rm10	11:58	0.09	0.02
Rm11	11:57	0.11	0.02
Rm12	7:21	3.05	0.07
Rm13	11:14	1.42	0.01
Rm14	7:15	2.93	0.06
Rm15	7:12	3.06	0.07
FO	11:55	1.27	0.01
SFO12	11:55	0.97	0.01
Rm16	7:41	0.07	0.03
Rm17	8:19	0.62	0.20
Rm18	12:05	16.23	0.28
Rm19	7:21	36.77	0.13
Rm20	7:35	3.80	0.01
Rm21	12:20	0.00	0.00
Rm22	6:13	0.43	0.00
Rm23	6:15	0.14	0.00
Rm24	6:16	2.31	0.01
Rm26	6:12	2.50	0.09
Rm27	12:20	34.27	34.27
Rm29	12:11	0.77	0.66
Rm30	12:02	1.07	0.50
H31	7:55	2.81	0.01
Rm31	6:23	1.92	0.00
Rm32	7:53	13.11	0.01
Rm33	7:55	13.23	0.01
Rm34	7:55	1.06	0.00
Rm35	11:37	0.85	0.00
Rm36	6:58	2.88	0.02
Rm37	7:56	2.27	0.01
Rm38	7:56	2.26	0.01
Rm39	7:56	2.26	0.01
Rm40	7:56	2.42	0.01
H40	6:09	1.72	0.01
SCA12	6:12	1.77	0.01

H41	6:09	2.15	0.01
Rm41	11:27	2.45	0.02
Rm42	11:25	1.95	0.01
Rm43	11:23	1.74	0.02
Rm44	11:21	1.62	0.02
Rm45	11:19	1.53	0.01
Rm46	11:17	1.47	0.01
Rm47	7:40	0.10	0.06
H48	6:09	7.24	0.01
Rm48	11:05	0.83	0.00
Rm49	11:03	0.82	0.00
Rm50	6:08	9.91	0.00
Rm51	6:51	1.22	0.00
H53	6:09	2.12	0.01
Rm52	6:11	1.18	0.01
STO24	6:09	1.89	0.00
Rm53	6:09	1.93	0.01
Rm54	7:35	0.91	0.00
SST12	6:09	1.31	0.00
Rm55	6:07	4.12	0.00
Rm56	6:08	3.12	0.00
SLN23	7:55	2.74	0.01
Rm57	7:56	2.20	0.01
SLS23	6:09	1.13	0.00
Rm58	6:13	1.17	0.00
Rm59	6:10	2.07	0.00
Rm60	6:10	1.18	0.00

Table 9 Blood MC (mg/L) in Children Exposure scenario – 2 canisters in room 27

Room	Time of peak	Blood MC at peak	Blood MC at 12:20
H1	6:07	5.47	0.02
Rm1	6:04	10.23	0.03
Rm2	6:19	0.25	0.03
Rm3	9:22	0.06	0.04
Rm4	6:24	0.13	0.04
Rm5	6:07	51.64	0.13
Rm6	9:09	19.27	0.03
Rm7	9:12	41.84	0.17
H8	11:55	0.91	0.01
Rm8	11:57	0.18	0.01
Rm9	12:03	0.06	0.03
Rm10	11:58	0.09	0.02
Rm11	11:57	0.11	0.02
Rm12	7:21	3.05	0.07
Rm13	11:14	1.42	0.01
Rm14	7:15	2.93	0.06
Rm15	7:12	3.06	0.07
FO	11:55	1.27	0.01
SFO12	11:55	0.97	0.01
Rm16	7:41	0.07	0.03
Rm17	8:19	0.62	0.20
Rm18	12:05	16.23	0.28
Rm19	7:21	36.77	0.13
Rm20	7:35	3.80	0.01
Rm21	12:20	0.00	0.00
Rm22	6:13	0.43	0.00
Rm23	6:15	0.14	0.00
Rm24	6:16	2.31	0.01
Rm26	6:12	2.50	0.10
Rm27	12:12	65.01	64.35
Rm29	6:28	0.65	0.11
Rm30	6:17	0.87	0.10
H31	7:55	2.81	0.01
Rm31	6:23	1.92	0.00
Rm32	7:53	13.11	0.01
Rm33	7:55	13.23	0.01
Rm34	7:55	1.06	0.00
Rm35	11:37	0.85	0.00
Rm36	6:58	2.88	0.02
Rm37	7:56	2.27	0.01
Rm38	7:56	2.26	0.01
Rm39	7:56	2.26	0.01

Rm40	7:56	2.42	0.01
H40	6:09	1.72	0.01
SCA12	6:12	1.77	0.01
H41	6:09	2.15	0.01
Rm41	11:27	2.45	0.02
Rm42	11:25	1.95	0.01
Rm43	11:23	1.74	0.02
Rm44	11:21	1.62	0.02
Rm45	11:19	1.53	0.01
Rm46	11:17	1.47	0.01
Rm47	7:40	0.10	0.06
H48	6:09	7.24	0.01
Rm48	11:05	0.83	0.00
Rm49	11:03	0.82	0.00
Rm50	6:08	9.91	0.00
Rm51	6:51	1.22	0.00
H53	6:09	2.12	0.01
Rm52	6:11	1.18	0.01
STO24	6:09	1.89	0.00
Rm53	6:09	1.93	0.01
Rm54	7:35	0.91	0.00
SST12	6:09	1.31	0.00
Rm55	6:07	4.12	0.00
Rm56	6:08	3.12	0.00
SLN23	7:55	2.74	0.01
Rm57	7:56	2.20	0.01
SLS23	6:09	1.13	0.00
Rm58	6:13	1.17	0.00
Rm59	6:10	2.07	0.00
Rm60	6:10	1.18	0.00

Table 10 Blood MC (mg/L) in Children Exposure scenario – 1.5 canisters in room 30, 0.5 in room 27

Room	Time of peak	Blood MC at peak	Blood MC at 12:20
H1	6:07	6.50	0.03
Rm1	6:04	10.23	0.02
Rm2	9:17	0.36	0.04
Rm3	9:48	0.09	0.07
Rm4	9:19	0.23	0.06
Rm5	6:07	51.60	0.13
Rm6	9:09	19.24	0.03
Rm7	9:12	41.53	0.17
H8	11:55	0.76	0.01
Rm8	6:15	0.64	0.01
Rm9	6:39	0.14	0.03
Rm10	6:34	0.14	0.02
Rm11	6:17	0.29	0.02
Rm12	7:21	2.97	0.07
Rm13	11:13	1.42	0.01
Rm14	7:15	2.85	0.06
Rm15	7:12	3.04	0.07
FO	11:55	1.44	0.01
SFO12	11:55	1.13	0.01
Rm16	6:36	0.10	0.03
Rm17	8:19	0.60	0.16
Rm18	12:05	16.25	0.28
Rm19	7:21	36.95	0.14
Rm20	7:35	3.87	0.02
Rm21	12:20	0.00	0.00
Rm22	6:13	0.43	0.00
Rm23	6:15	0.14	0.00
Rm24	6:16	2.31	0.01
Rm26	6:12	2.48	0.07
Rm27	12:10	15.77	15.52
Rm29	11:53	2.31	0.26
Rm30	11:50	10.22	0.21
H31	7:55	2.74	0.01
Rm31	6:23	1.86	0.00
Rm32	7:53	13.38	0.01
Rm33	7:55	13.44	0.01
Rm34	7:55	1.08	0.01
Rm35	11:37	0.87	0.00
Rm36	6:58	3.13	0.02
Rm37	6:26	2.26	0.01

Rm38	7:56	2.21	0.01
Rm39	7:56	2.21	0.01
Rm40	7:56	2.37	0.01
H40	6:12	1.87	0.01
SCA12	6:12	1.90	0.01
H41	6:09	2.47	0.01
Rm41	11:28	2.69	0.03
Rm42	11:25	2.02	0.01
Rm43	11:23	1.78	0.02
Rm44	11:21	1.65	0.02
Rm45	11:19	1.55	0.01
Rm46	11:17	1.49	0.01
Rm47	7:39	0.15	0.09
H48	6:09	7.35	0.01
Rm48	11:05	0.84	0.00
Rm49	11:03	0.83	0.00
Rm50	6:08	9.95	0.00
Rm51	6:51	1.31	0.00
H53	6:09	2.44	0.01
Rm52	6:11	1.38	0.01
STO24	6:09	2.21	0.00
Rm53	6:09	2.25	0.01
Rm54	7:35	0.91	0.01
SST12	6:09	1.31	0.00
Rm55	6:07	4.12	0.01
Rm56	6:08	3.13	0.01
SLN23	7:55	2.67	0.01
Rm57	7:56	2.15	0.01
SLS23	6:09	1.14	0.00
Rm58	6:13	1.17	0.00
Rm59	6:10	2.11	0.00
Rm60	6:10	1.35	0.00

Table 11 Blood %COHb in Adults Exposure scenario – 2 canisters in room 30

Room	Time of peak	%COHb at peak	%COHb at 12:20
Rm1	9:21	2.09	1.94
Rm2	10:51	1.93	1.90
Rm3	12:20	1.75	1.75
Rm4	11:51	1.93	1.93
Rm5	9:20	4.16	3.46
Rm6	10:7	2.21	2.10
Rm7	11:42	3.44	3.37
H8	7:44	1.68	1.63
Rm8	7:45	1.67	1.62
Rm9	9:14	1.73	1.68
Rm10	8:42	1.67	1.63
Rm11	8:35	1.69	1.64
Rm12	11:57	2.01	2.00
Rm13	11:51	1.58	1.58
Rm14	11:53	1.96	1.96
Rm15	12:5	2.07	2.06
FO	7:43	1.68	1.63
SFO12	7:41	1.68	1.63
Rm16	9:18	1.67	1.64
Rm17	9:52	2.40	2.32
Rm18	12:20	2.46	2.46
Rm19	9:27	4.45	3.79
Rm20	8:28	1.96	1.82
Rm21	6:0	1.50	1.50
Rm22	8:35	1.55	1.54
Rm23	8:48	1.55	1.54
Rm24	8:35	2.17	1.91
Rm26	12:10	1.93	1.93
Rm27	12:20	1.73	1.73
Rm29	12:20	2.02	2.02
Rm30	12:20	1.96	1.96
H31	8:32	1.75	1.68
Rm31	8:22	1.63	1.58
Rm32	9:10	1.72	1.67
Rm33	9:15	1.72	1.68
Rm34	12:7	1.53	1.53
Rm35	12:12	1.52	1.52
Rm36	8:31	1.93	1.81
Rm37	8:31	1.77	1.69
Rm38	8:35	1.75	1.68
Rm39	8:34	1.75	1.68
Rm40	8:32	1.77	1.69
H40	7:54	1.75	1.67
SCA12	7:57	1.78	1.69
H41	7:54	1.74	1.67
Rm41	12:20	1.66	1.66
Rm42	12:4	1.58	1.58
Rm43	12:19	1.58	1.58

Rm44	12:20	1.58	1.58
Rm45	11:56	1.55	1.55
Rm46	11:56	1.55	1.55
Rm47	12:20	1.92	1.92
H48	7:56	1.76	1.66
Rm48	11:37	1.54	1.54
Rm49	11:37	1.54	1.54
Rm50	7:60	1.71	1.62
Rm51	7:58	1.70	1.63
H53	7:54	1.75	1.69
Rm52	8:21	1.68	1.67
STO24	8:14	1.65	1.60
Rm53	8:18	1.73	1.67
Rm54	8:32	1.65	1.62
SST12	8:31	1.61	1.57
Rm55	8:29	1.68	1.62
Rm56	8:29	1.71	1.63
SLN23	8:35	1.73	1.67
Rm57	8:37	1.76	1.70
SLS23	8:2	1.61	1.56
Rm58	8:11	1.63	1.57
Rm59	8:15	1.62	1.58
Rm60	8:14	1.62	1.59

Table 12 Blood %COHb in Adults Exposure scenario – 2 canisters in room 8

Room	Time of peak	%COHb at peak	%COHb at 12:20
Rm1	9:48	2.14	2.03
Rm2	10:8	1.72	1.71
Rm3	12:20	1.64	1.64
Rm4	10:31	1.68	1.67
Rm5	9:20	4.18	3.48
Rm6	10:6	2.25	2.13
Rm7	11:42	3.49	3.42
H8	12:11	1.56	1.56
Rm8	12:20	2.34	2.34
Rm9	12:20	1.56	1.56
Rm10	12:20	1.56	1.56
Rm11	12:20	1.57	1.57
Rm12	11:56	2.04	2.04
Rm13	11:51	1.58	1.58
Rm14	11:52	1.99	1.98
Rm15	11:53	2.07	2.06
FO	12:17	1.54	1.54
SFO12	12:12	1.55	1.55
Rm16	9:29	1.59	1.59
Rm17	9:56	2.43	2.37
Rm18	12:20	2.47	2.47
Rm19	9:27	4.42	3.76
Rm20	8:32	1.86	1.73
Rm21	6:0	1.50	1.50
Rm22	8:35	1.55	1.54
Rm23	8:48	1.55	1.54
Rm24	8:35	2.17	1.91
Rm26	12:15	1.94	1.94
Rm27	12:13	1.95	1.95
Rm29	12:20	2.14	2.14
Rm30	12:20	2.14	2.14
H31	8:38	1.72	1.66
Rm31	8:22	1.63	1.58
Rm32	9:10	1.71	1.66
Rm33	9:15	1.71	1.68
Rm34	12:7	1.53	1.53
	12:12	1.52	
Rm35			1.52
Rm36	8:35	1.84	1.75
Rm37	8:35	1.75	1.67
Rm38	8:40	1.72	1.66
Rm39	8:38	1.73	1.66
Rm40	8:36	1.74	1.67
H40	7:54	1.68	1.63
SCA12	7:54	1.73	1.66
H41	7:55	1.63	1.61
Rm41	12:17	1.62	1.62

Rm42	12:4	1.58	1.57
Rm43	12:18	1.58	1.58
Rm44	12:20	1.58	1.58
Rm45	11:56	1.55	1.55
Rm46	11:55	1.54	1.54
Rm47	12:20	1.76	1.76
H48	7:56	1.71	1.63
Rm48	11:37	1.54	1.54
Rm49	11:37	1.54	1.54
Rm50	7:59	1.71	1.62
Rm51	8:1	1.64	1.59
H53	8:20	1.65	1.63
Rm52	12:1	1.64	1.63
STO24	8:15	1.63	1.59
Rm53	8:19	1.65	1.62
Rm54	8:31	1.65	1.60
SST12	8:31	1.61	1.57
Rm55	8:28	1.68	1.61
Rm56	8:28	1.70	1.62
SLN23	8:41	1.70	1.65
Rm57	8:43	1.73	1.69
SLS23	8:3	1.61	1.56
Rm58	8:12	1.63	1.57
Rm59	8:15	1.62	1.58
Rm60	8:15	1.61	1.58

Table 13 Blood %COHb in Adults Exposure scenario – 1 canisters in room 8, 1 in room 27

Room	Time of peak	%COHb at peak	%COHb at 12:20
Rm1	9:48	2.14	2.03
Rm2	10:8	1.72	1.71
Rm3	12:20	1.64	1.64
Rm4	10:31	1.68	1.67
Rm5	9:20	4.18	3.48
Rm6	10:6	2.25	2.13
Rm7	11:42	3.49	3.42
H8	12:11	1.56	1.56
Rm8	12:20	2.16	2.16
Rm9	12:20	1.56	1.56
Rm10	12:20	1.56	1.56
Rm11	12:20	1.57	1.57
Rm12	11:56	2.04	2.04
Rm13	11:51	1.58	1.58
Rm14	11:52	1.99	1.98
Rm15	11:53	2.07	2.06
FO	12:17	1.54	1.54
SFO12	12:12	1.55	1.55
Rm16	9:29	1.59	1.59
Rm17	9:56	2.43	2.37
Rm18	12:20	2.47	2.47
Rm19	9:27	4.42	3.76
Rm20	8:32	1.86	1.73
Rm21	6:0	1.50	1.50
Rm22	8:35	1.55	1.54
Rm23	8:48	1.55	1.54
Rm24	8:35	2.17	1.91
Rm26	7:58	1.92	1.90
Rm27	12:20	2.82	2.82
Rm29	12:20	2.01	2.01
Rm30	12:20	2.05	2.05
H31	8:38	1.72	1.66
Rm31	8:22	1.63	1.58
Rm32	9:10	1.71	1.66
Rm33	9:15	1.71	1.68
Rm34	12:7	1.53	1.53
Rm35	12:12	1.52	1.52
Rm36	8:35	1.84	1.75
Rm37	8:35	1.75	1.67
Rm38	8:40	1.72	1.66
Rm39	8:38	1.73	1.66
Rm40	8:36	1.74	1.67
H40	7:54	1.68	1.63

SCA12	7:54	1.73	1.66
H41	7:55	1.63	1.61
Rm41	12:17	1.62	1.62
Rm42	12:4	1.58	1.57
Rm43	12:18	1.58	1.58
Rm44	12:20	1.58	1.58
Rm45	11:56	1.55	1.55
Rm46	11:55	1.54	1.54
Rm47	12:20	1.76	1.76
H48	7:56	1.71	1.63
Rm48	11:37	1.54	1.54
Rm49	11:37	1.54	1.54
Rm50	7:59	1.71	1.62
Rm51	8:1	1.64	1.59
H53	8:20	1.65	1.63
Rm52	12:1	1.64	1.63
STO24	8:15	1.63	1.59
Rm53	8:19	1.65	1.62
Rm54	8:31	1.65	1.60
SST12	8:31	1.61	1.57
Rm55	8:28	1.68	1.61
Rm56	8:28	1.70	1.62
SLN23	8:41	1.70	1.65
Rm57	8:43	1.73	1.69
SLS23	8:3	1.61	1.56
Rm58	8:12	1.63	1.57
Rm59	8:15	1.62	1.58
Rm60	8:15	1.61	1.58

Table 14 Blood %COHb in Adults Exposure scenario – 2 canisters in room 27

Room	Time of peak	%COHb at peak	%COHb at 12:20
Rm1	9:48	2.14	2.03
Rm2	10:8	1.72	1.71
Rm3	12:20	1.64	1.64
Rm4	10:31	1.68	1.67
Rm5	9:20	4.18	3.48
Rm6	10:6	2.25	2.13
Rm7	11:42	3.49	3.42
Н8	12:11	1.56	1.56
Rm8	12:18	1.56	1.56
Rm9	12:20	1.56	1.56
Rm10	12:20	1.56	1.56
Rm11	12:20	1.57	1.57
Rm12	11:56	2.04	2.04
Rm13	11:51	1.58	1.58
Rm14	11:52	1.99	1.98
Rm15	11:53	2.07	2.06
FO	12:17	1.54	1.54
SFO12	12:12	1.55	1.55
Rm16	9:29	1.59	1.59
Rm17	9:56	2.43	2.37
Rm18	12:20	2.47	2.47
Rm19	9:27	4.42	3.76
Rm20	8:32	1.86	1.73
Rm21	6:0	1.50	1.50
Rm22	8:35	1.55	1.54
Rm23	8:48	1.55	1.54
Rm24	8:35	2.17	1.91
Rm26	7:58	1.92	1.86
Rm27	12:20	2.84	2.84
Rm29	8:25	1.95	1.85
Rm30	8:11	1.91	1.83
H31	8:38	1.72	1.66
Rm31	8:22	1.63	1.58
Rm32	9:10	1.71	1.66
Rm33	9:15	1.71	1.68
Rm34	12:7	1.53	1.53
Rm35	12:12	1.52	1.52
Rm36	8:35	1.84	1.75
Rm37	8:35	1.75	1.67
Rm38	8:40	1.72	1.66

Rm39	8:38	1.73	1.66
Rm40	8:36	1.74	1.67
H40	7:54	1.68	1.63
SCA12	7:54	1.73	1.66
H41	7:55	1.63	1.61
Rm41	12:17	1.62	1.62
Rm42	12:4	1.58	1.57
Rm43	12:18	1.58	1.58
Rm44	12:20	1.58	1.58
Rm45	11:56	1.55	1.55
Rm46	11:55	1.54	1.54
Rm47	12:20	1.76	1.76
H48	7:56	1.71	1.63
Rm48	11:37	1.54	1.54
Rm49	11:37	1.54	1.54
Rm50	7:59	1.71	1.62
Rm51	8:1	1.64	1.59
H53	8:20	1.65	1.63
Rm52	12:1	1.64	1.63
STO24	8:15	1.63	1.59
Rm53	8:19	1.65	1.62
Rm54	8:31	1.65	1.60
SST12	8:31	1.61	1.57
Rm55	8:28	1.68	1.61
Rm56	8:28	1.70	1.62
SLN23	8:41	1.70	1.65
Rm57	8:43	1.73	1.69
SLS23	8:3	1.61	1.56
Rm58	8:12	1.63	1.57
Rm59	8:15	1.62	1.58
Rm60	8:15	1.61	1.58

Table 15 Blood %COHb in Adults Exposure scenario – 1.5 canisters in room 30, 0.5 in room 27

Room	Time of peak	%COHb at peak	%COHb at 12:20
H1	9:25	2.34	2.12
Rm1	9:27	2.10	1.96
Rm2	10:46	1.88	1.85
Rm3	12:20	1.72	1.72
Rm4	11:49	1.87	1.87
Rm5	9:20	4.17	3.46
Rm6	10:7	2.22	2.11
Rm7	11:42	3.45	3.38
H8	7:45	1.65	1.61
Rm8	7:47	1.64	1.61
Rm9	9:14	1.69	1.65
Rm10	8:43	1.64	1.61
			1.62
Rm11	8:37	1.65	
Rm12	11:57	2.02	2.01
Rm13	11:51	1.58	1.58
Rm14	11:53	1.97	1.96
Rm15	12:3	2.07	2.06
FO	7:42	1.65	1.61
SFO12	7:41	1.65	1.61
Rm16	9:20	1.65	1.63
Rm17	9:54	2.41	2.34
Rm18	12:20	2.47	2.47
Rm19	9:27	4.44	3.78
Rm20	8:29	1.94	1.80
Rm21	6:0	1.50	1.50
Rm22	8:35	1.55	1.54
Rm23	8:48	1.55	1.54
Rm24	8:35	2.17	1.91
Rm26	9:22	1.92	1.91
Rm27	12:20	2.56	2.56
Rm29	12:20	1.99	1.99
Rm30	12:20	1.95	1.95
H31	8:33	1.74	1.67
Rm31	8:22	1.63	1.58
Rm32	9:10	1.72	1.66
Rm33	9:15	1.72	1.68
Rm34	12:7	1.53	1.53
Rm35	12:12	1.52	1.52
Rm36	8:32	1.91	1.79
Rm37	8:32	1.76	1.69
Rm38	8:36	1.74	1.67
Rm39	8:35	1.74	1.68
Rm40	8:33	1.76	1.69
H40	7:54	1.73	1.66
SCA12	7:56	1.76	1.68
H41	7:54	1.71	1.65
Rm41	12:20	1.65	1.65
Rm42	12:5	1.58	1.58
	1		

	1.2.10	1.50	1.70
Rm43	12:18	1.58	1.58
Rm44	12:20	1.58	1.58
Rm45	11:57	1.55	1.55
Rm46	11:55	1.55	1.54
Rm47	12:20	1.88	1.88
H48	7:56	1.75	1.65
Rm48	11:37	1.54	1.54
Rm49	11:37	1.54	1.54
Rm50	7:59	1.71	1.62
Rm51	7:58	1.68	1.62
H53	8:19	1.73	1.67
Rm52	8:21	1.67	1.66
STO24	8:14	1.64	1.60
Rm53	8:18	1.71	1.65
Rm54	8:31	1.65	1.61
SST12	8:31	1.61	1.57
Rm55	8:29	1.68	1.62
Rm56	8:28	1.70	1.63
SLN23	8:36	1.72	1.66
Rm57	8:38	1.75	1.70
SLS23	8:2	1.61	1.56
Rm58	8:12	1.63	1.57
Rm59	8:15	1.62	1.58
Rm60	8:15	1.62	1.59

Table 16 Blood %COHb in Children Exposure scenario – 2 canisters in room 30

	o – 2 canisters in room 30		1
Room	Time of peak	%COHb at peak	%COHb at 12:20
Rm1	9:20	2.23	1.96
Rm2	10:36	2.06	1.97
Rm3	12:20	1.81	1.81
Rm4	11:15	2.05	2.02
Rm5	8:13	4.81	3.53
Rm6	9:53	2.45	2.18
Rm7	10:47	3.95	3.74
H8	7:40	1.76	1.64
Rm8	7:40	1.73	1.63
Rm9	8:52	1.81	1.70
Rm10	8:23	1.73	1.64
Rm11	8:18	1.75	1.65
Rm12	11:54	2.14	2.13
Rm13	11:45	1.59	1.59
Rm14	11:50	2.09	2.07
Rm15	12:1	2.22	2.20
FO	7:20	1.75	1.64
SFO12	7:20	1.75	1.63
Rm16	8:60	1.72	1.65
Rm17	9:31	2.69	2.46
Rm18	8:36	2.72	2.64
Rm19	8:58	5.41	3.93
Rm20	8:23	2.13	1.84
Rm21	6:0	1.50	1.49
Rm22	8:30	1.56	1.53
Rm23	8:42	1.56	1.53
Rm24	8:5	2.42	1.92
Rm26	7:27	2.05	2.00
Rm27	12:20	1.80	1.80
Rm29	12:20	2.21	2.21
Rm30	12:20	2.11	2.11
H31	8:24	1.84	1.69
Rm31	7:25	1.67	1.58
Rm32	8:52	1.80	1.68
Rm33	8:56	1.80	1.70
Rm34	12:4	1.53	1.53
Rm35	12:5	1.52	1.52
Rm36	8:24	2.09	1.83
Rm37	8:24	1.87	1.70
Rm38	8:25	1.84	1.69
Rm39	8:25	1.84	1.69
Rm40	8:24	1.87	1.70
H40	7:41	1.84	1.68
SCA12	7:54	1.88	1.70
H41	7:34	1.83	1.68
Rm41	12:13	1.70	1.70
Rm42	11:59	1.60	1.60
Rm43	12:11	1.60	1.60

Rm44	12:16	1.61	1.61
Rm45	11:51	1.56	1.56
Rm46	11:49	1.55	1.55
Rm47	11:41	2.00	2.00
H48	7:16	1.86	1.66
Rm48	11:33	1.54	1.54
Rm49	11:32	1.54	1.54
Rm50	7:56	1.78	1.61
Rm51	7:52	1.77	1.63
H53	7:41	1.85	1.70
Rm52	8:18	1.74	1.69
STO24	7:39	1.70	1.60
Rm53	7:41	1.81	1.68
Rm54	8:27	1.70	1.62
SST12	7:9	1.65	1.57
Rm55	8:26	1.74	1.62
Rm56	8:3	1.77	1.64
SLN23	8:25	1.82	1.68
Rm57	8:26	1.86	1.72
SLS23	7:58	1.64	1.56
Rm58	7:59	1.67	1.57
Rm59	7:39	1.66	1.58
Rm60	7:38	1.67	1.59

Table 17 Blood %COHb in Children Exposure scenario – 2 canisters in room 8

Room	Time of peak	%COHb at peak	%COHb at 12:20
Rm1	9:43	2.30	2.08
Rm2	9:60	1.79	1.74
Rm3	12:20	1.67	1.67
Rm4	10:17	1.72	1.70
Rm5	8:14	4.83	3.55
Rm6	9:51	2.50	2.21
Rm7	10:47	4.02	3.80
H8	12:10	1.57	1.57
Rm8	12:20	2.69	2.69
Rm9	12:20	1.57	1.57
Rm10	12:20	1.57	1.57
Rm11	12:20	1.57	1.57
Rm12	11:53	2.19	2.17
Rm13	11:45	1.59	1.59
Rm14	11:49	2.12	2.10
Rm15	11:49	2.22	2.19
FO	12:15	1.55	1.55
SFO12	12:10	1.55	1.55
Rm16	9:14	1.62	1.59
Rm17	9:34	2.74	2.52
Rm18	8:35	2.73	2.64
Rm19	8:58	5.37	3.90
Rm20	8:24	2.00	1.74
Rm21	6:0	1.50	1.49
Rm22	8:30	1.56	1.53
Rm23	8:43	1.56	1.53
Rm24	8:5	2.42	1.92
Rm26	7:29	2.08	2.03
Rm27	12:20	2.05	2.05
Rm29	12:20	2.32	2.32
Rm30	12:20	2.44	2.44
H31	8:27	1.80	1.67
Rm31	7:25	1.67	1.58
Rm32	8:52	1.79	1.67
Rm33	8:56	1.79	1.69
Rm34	12:3	1.53	1.53
Rm35	12:5	1.52	1.52
Rm36	8:25	1.97	1.77
Rm37	8:25	1.84	1.69
Rm38	8:27	1.80	1.67
Rm39	8:27	1.81	1.67
Rm40	8:26	1.84	1.68
H40	7:42	1.75	1.64
SCA12	7:41	1.82	1.67
H41	7:42	1.68	1.61
Rm41	12:10	1.65	1.65
Rm42	11:58	1.59	1.59

Rm43	12:10	1.59	1.59
Rm44	12:15	1.60	1.60
Rm45	11:50	1.56	1.55
Rm46	11:48	1.55	1.55
Rm47	12:20	1.81	1.81
H48	7:14	1.78	1.63
Rm48	11:33	1.54	1.54
Rm49	11:32	1.54	1.54
Rm50	7:56	1.78	1.61
Rm51	7:53	1.69	1.60
H53	7:42	1.70	1.64
Rm52	8:18	1.67	1.65
STO24	7:39	1.67	1.59
Rm53	7:41	1.70	1.63
Rm54	8:27	1.70	1.61
SST12	7:9	1.65	1.57
Rm55	8:26	1.74	1.61
Rm56	8:3	1.77	1.62
SLN23	8:28	1.77	1.66
Rm57	8:30	1.82	1.70
SLS23	7:58	1.64	1.55
Rm58	7:59	1.67	1.57
Rm59	7:39	1.66	1.58
Rm60	7:38	1.65	1.58

Table 18
Blood %COHb in Children
Exposure scenario – 1 canisters in room 8, 1 in room 27

Room	Time of peak	%COHb at peak	%COHb at 12:20
Rm1	9:43	2.30	2.08
Rm2	9:60	1.79	1.74
Rm3	12:20	1.67	1.67
Rm4	10:17	1.72	1.70
Rm5	8:14	4.83	3.55
Rm6	9:51	2.50	2.21
Rm7	10:47	4.02	3.80
Н8	12:10	1.57	1.57
Rm8	12:20	2.42	2.42
Rm9	12:20	1.57	1.57
Rm10	12:20	1.57	1.57
Rm11	12:20	1.57	1.57
Rm12	11:53	2.19	2.17
Rm13	11:45	1.59	1.59
Rm14	11:49	2.12	2.10
Rm15	11:49	2.22	2.19
FO	12:15	1.55	1.55
SFO12	12:10	1.55	1.55
Rm16	9:14	1.62	1.59
Rm17	9:34	2.74	2.52
Rm18	8:35	2.73	2.64
Rm19	8:58	5.37	3.90
Rm20	8:24	2.00	1.74
Rm21	6:0	1.50	1.49
Rm22	8:30	1.56	1.53
Rm23	8:43	1.56	1.53
Rm24	8:5	2.42	1.92
Rm26	7:29	2.08	1.96
Rm27	12:20	3.33	3.33
Rm29	12:20	2.12	2.12
Rm30	12:20	2.19	2.19
H31	8:27	1.80	1.67
Rm31	7:25	1.67	1.58
Rm32	8:52	1.79	1.67
Rm33	8:56	1.79	1.69
Rm34	12:3	1.53	1.53
Rm35	12:5	1.52	1.52
Rm36	8:25	1.97	1.77
Rm37	8:25	1.84	1.69
Rm38	8:27	1.80	1.67
Rm39	8:27	1.81	1.67
Rm40	8:26	1.84	1.68
H40	7:42	1.75	1.64
SCA12	7:41	1.82	1.67
H41	7:42	1.68	1.61
	i e	i e e e e e e e e e e e e e e e e e e e	

Rm41	12:10	1.65	1.65
Rm42	11:58	1.59	1.59
Rm43	12:10	1.59	1.59
Rm44	12:15	1.60	1.60
Rm45	11:50	1.56	1.55
Rm46	11:48	1.55	1.55
Rm47	12:20	1.81	1.81
H48	7:14	1.78	1.63
Rm48	11:33	1.54	1.54
Rm49	11:32	1.54	1.54
Rm50	7:56	1.78	1.61
Rm51	7:53	1.69	1.60
H53	7:42	1.70	1.64
Rm52	8:18	1.67	1.65
STO24	7:39	1.67	1.59
Rm53	7:41	1.70	1.63
Rm54	8:27	1.70	1.61
SST12	7:9	1.65	1.57
Rm55	8:26	1.74	1.61
Rm56	8:3	1.77	1.62
SLN23	8:28	1.77	1.66
Rm57	8:30	1.82	1.70
SLS23	7:58	1.64	1.55
Rm58	7:59	1.67	1.57
Rm59	7:39	1.66	1.58
Rm60	7:38	1.65	1.58

Table 19
Blood %COHb in Children
Exposure scenario – 2 canisters in room 27

Room	Time of peak	%COHb at peak	%COHb at 12:20
Rm1	9:43	2.30	2.08
Rm2	9:60	1.79	1.74
Rm3	12:20	1.67	1.67
Rm4	10:17	1.72	1.70
Rm5	8:14	4.83	3.55
Rm6	9:51	2.50	2.21
Rm7	10:47	4.02	3.80
H8	12:10	1.57	1.57
Rm8	12:16	1.57	1.57
Rm9	12:20	1.57	1.57
Rm10	12:20	1.57	1.57
Rm11	12:20	1.57	1.57
Rm12	11:53	2.19	2.17
Rm13	11:45	1.59	1.59
Rm14	11:49	2.12	2.10
Rm15	11:49	2.22	2.19
FO	12:15	1.55	1.55
SFO12	12:10	1.55	1.55
Rm16	9:14	1.62	1.59
Rm17	9:34	2.74	2.52
Rm18	8:35	2.73	2.64
Rm19	8:58	5.37	3.90
Rm20	8:24	2.00	1.74
Rm21	6:0	1.50	1.49
Rm22	8:30	1.56	1.53
Rm23	8:43	1.56	1.53
Rm24	8:5	2.42	1.92
Rm26	7:29	2.08	1.91
Rm27	12:20	3.36	3.36
Rm29	8:3	2.12	1.89
Rm30	7:56	2.07	1.87
H31	8:27	1.80	1.67
Rm31	7:25	1.67	1.58
Rm32	8:52	1.79	1.67
Rm33	8:56	1.79	1.69
Rm34	12:3	1.53	1.53
Rm35	12:5	1.52	1.52
Rm36	8:25	1.97	1.77
Rm37	8:25	1.84	1.69
Rm38	8:27	1.80	1.67
Rm39	8:27	1.81	1.67
Rm40	8:26	1.84	1.68
H40	7:42	1.75	1.64

SCA12	7:41	1.82	1.67
H41	7:42	1.68	1.61
Rm41	12:10	1.65	1.65
Rm42	11:58	1.59	1.59
Rm43	12:10	1.59	1.59
Rm44	12:15	1.60	1.60
Rm45	11:50	1.56	1.55
Rm46	11:48	1.55	1.55
Rm47	12:20	1.81	1.81
H48	7:14	1.78	1.63
Rm48	11:33	1.54	1.54
Rm49	11:32	1.54	1.54
Rm50	7:56	1.78	1.61
Rm51	7:53	1.69	1.60
H53	7:42	1.70	1.64
Rm52	8:18	1.67	1.65
STO24	7:39	1.67	1.59
Rm53	7:41	1.70	1.63
Rm54	8:27	1.70	1.61
SST12	7:9	1.65	1.57
Rm55	8:26	1.74	1.61
Rm56	8:3	1.77	1.62
SLN23	8:28	1.77	1.66
Rm57	8:30	1.82	1.70
SLS23	7:58	1.64	1.55
Rm58	7:59	1.67	1.57
Rm59	7:39	1.66	1.58
Rm60	7:38	1.65	1.58

Table 20 Blood %COHb in Children Exposure scenario – 1.5 canisters in room 30, 0.5 in room 27

	%COHb at peak	%COHb at 12:20
		2.16
		1.99
		1.91
		1.77
		1.94
		3.54
		2.19
		3.75
		1.62
		1.61
		1.66
		1.62
		1.63
		2.14
		1.59
		2.07
		2.07
		1.61
		1.61
		1.64
		2.47
		2.64
		3.92
		1.81
		1.49
		1.53
		1.53
		1.92
		1.98
		3.01
		2.15
		2.08
		1.68
		1.57
		1.67
		1.70
12:6	1.53	1.53
		1.52
		1.81
8:25		1.70
		1.68
8:26	1.83	1.68
8:25	1.86	1.70
7:41	1.81	1.67
7:54	1.86	1.69
7:41	1.78	1.66
12:13	1.69	1.69
11:60	1.59	1.59
	12:9 8:24 8:25 8:26 8:26 8:25 7:41 7:54 7:41 12:13	9:23 2.55 9:27 2.25 10:32 1.99 12:20 1.77 11:11 1.96 8:14 4.81 9:52 2.46 10:47 3.97 7:40 1.70 7:41 1.68 8:53 1.74 8:27 1.68 8:23 1.70 11:53 2.15 11:47 1.59 11:50 2.09 11:50 2.09 11:50 2.22 7:39 1.69 7:22 1.70 9:4 1.69 9:32 2.70 8:36 2.72 8:58 5.39 8:24 2.09 12:20 1.49 8:31 1.55 8:44 1.55 8:6 2.42 7:27 2.05 12:20 3.01 12:20 2.08 8:25 1.83 7:27 1.67 <td< td=""></td<>

Rm43	12:12	1.60	1.60
		1.60	
Rm44	12:16	1.60	1.60
Rm45	11:52	1.55	1.55
Rm46	11:51	1.55	1.55
Rm47	12:20	1.95	1.95
H48	7:16	1.84	1.65
Rm48	11:35	1.54	1.54
Rm49	11:34	1.54	1.53
Rm50	7:56	1.77	1.61
Rm51	7:53	1.74	1.62
H53	7:41	1.80	1.69
Rm52	8:18	1.72	1.67
STO24	7:39	1.69	1.59
Rm53	7:41	1.78	1.66
Rm54	8:27	1.69	1.62
SST12	7:10	1.64	1.56
Rm55	8:26	1.74	1.62
Rm56	8:3	1.76	1.63
SLN23	8:26	1.80	1.67
Rm57	8:27	1.84	1.72
SLS23	7:58	1.64	1.55
Rm58	8:1	1.67	1.57
Rm59	7:39	1.66	1.58
Rm60	7:38	1.66	1.58

Appendix B

Figures: Methylene Chloride and Carbon Monoxide model results

Figure 1 MC air concentration, MC blood concentration, CO in blood and %COHb from 6AM to 12:20PM Child in room 27; exposure scenario – two canisters in room 27

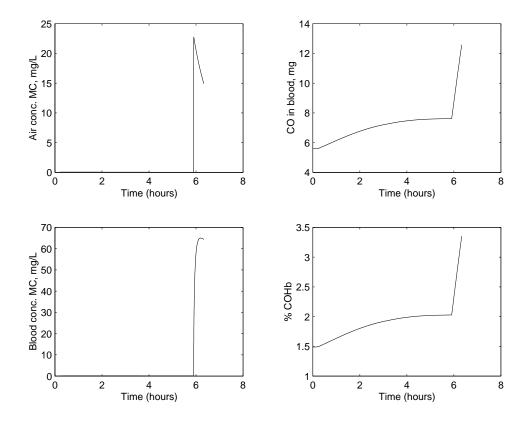


Figure 2 MC air concentration, MC blood concentration, CO in blood and %COHb from 6AM to 12:20PM Child moving from Room 19 to Room 27 at 8:30; exposure scenario 2 canisters in room 27

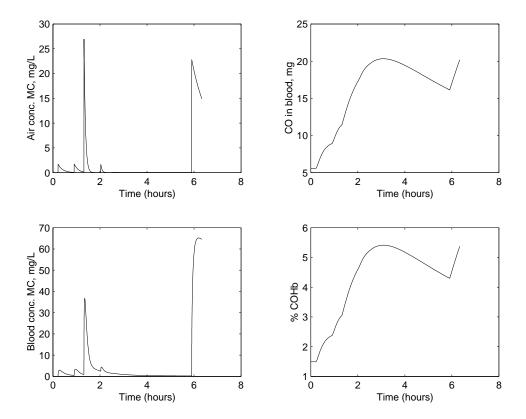


Figure 3 MC air concentration, MC blood concentration, CO in blood and %COHb from 6AM to 12:20PM Child in room 8; exposure scenario two canisters in room 8

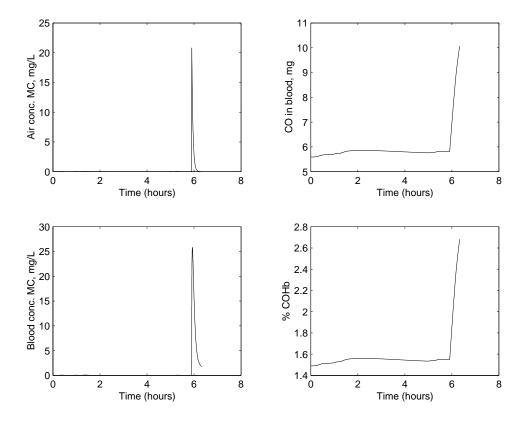


Figure 4 MC air concentration, MC blood concentration, CO in blood and %COHb from 6AM to 12:20PM Child in room 8; exposure scenario is one canister in room 8 and one in room 27

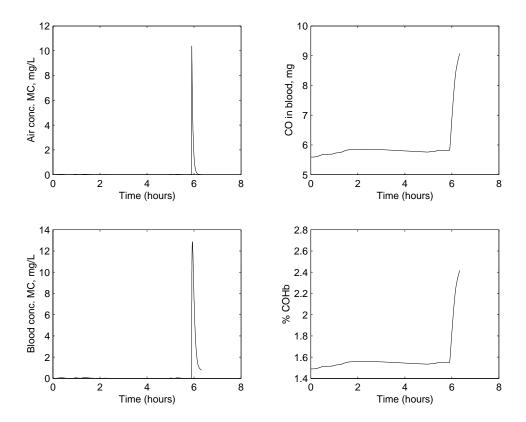


Figure 5 MC air concentration, MC blood concentration, CO in blood and %COHb from 6AM to 12:20PM Child in room 27; exposure scenario one canister in room 8, one in room 27

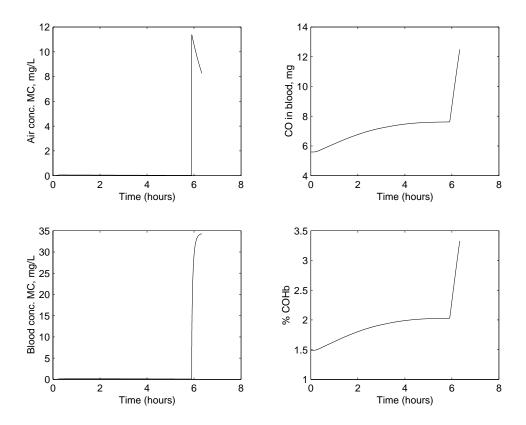


Figure 6 MC air concentration, MC blood concentration, CO in blood and %COHb from 6AM to 12:20PM Child in room 30; exposure scenario two canisters in room 30

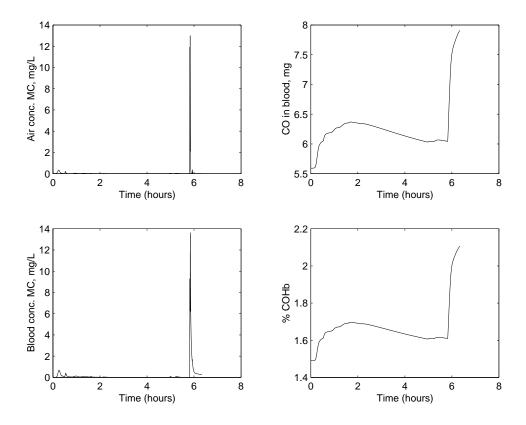


Figure 7 MC air concentration, MC blood concentration, CO in blood and %COHb from 6AM to 12:20PM Child moving from Room 19 to Room 27 at 8:30; exposure scenario 1.5 canisters in room 30 and 0.5 in room 27

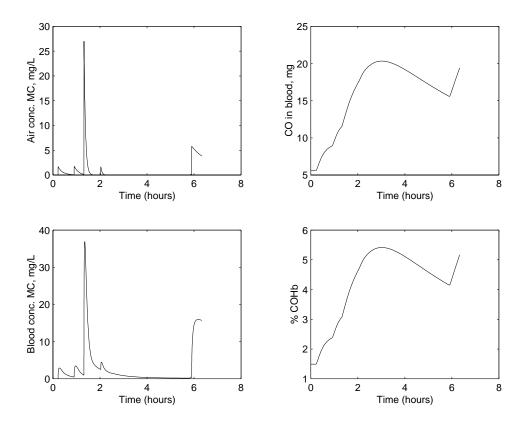


Figure 8 MC air concentration, MC blood concentration, CO in blood and %COHb from 6AM to 12:20PM Adult in room 27; exposure scenario two canisters in room 27

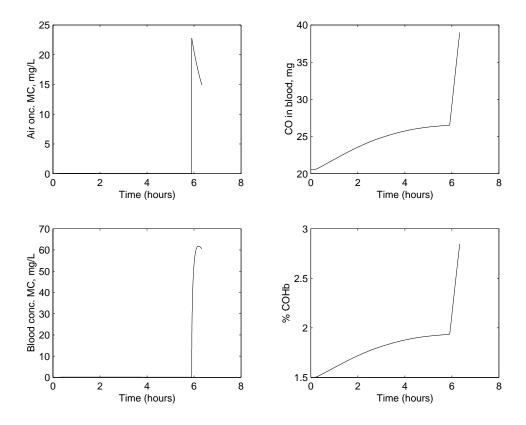


Figure 9 MC air concentration, MC blood concentration, CO in blood and %COHb from 6AM to 12:20PM Adult moving from room 19 to room 27 at 8:30; exposure scenario is two canisters in room 27

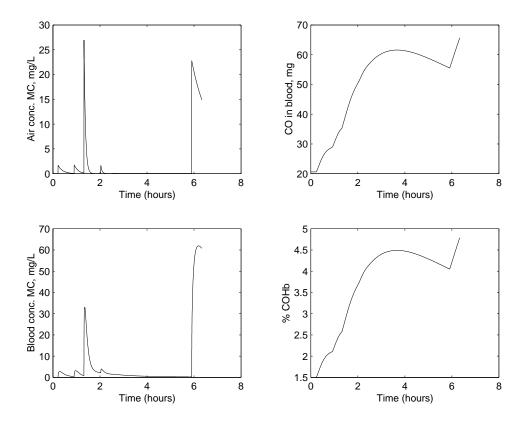


Figure 10 MC air concentration, MC blood concentration, CO in blood and %COHb from 6AM to 12:20PM Adult in room 8; exposure scenario two canisters in room 8

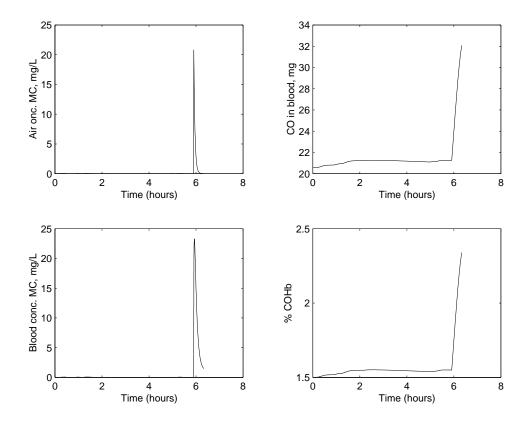


Figure 11 MC air concentration, MC blood concentration, CO in blood and %COHb from 6AM to 12:20PM Adult in room 8; exposure scenario one canister in room 8 and one in room 27

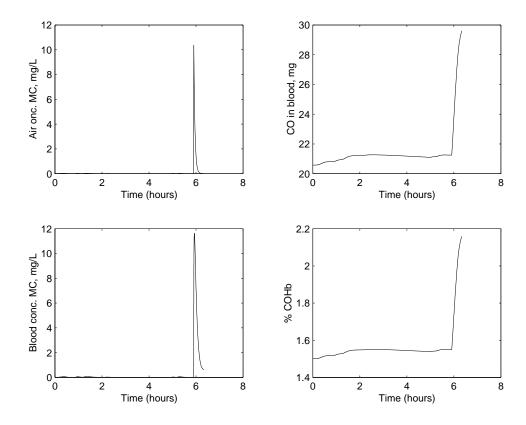


Figure 12 MC air concentration, MC blood concentration, CO in blood and %COHb from 6AM to 12:20PM Adult in room 27; exposure scenario one canister in room 8 and one in room 27

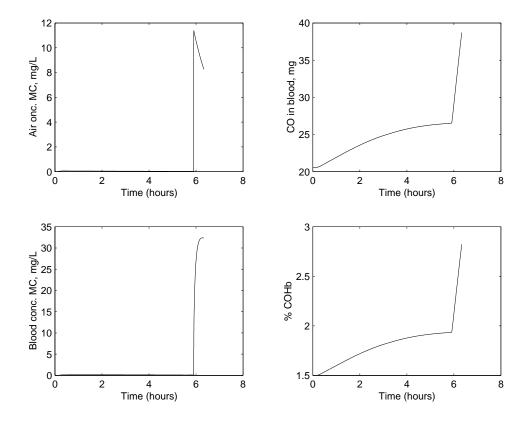


Figure 13 MC air concentration, MC blood concentration, CO in blood and %COHb from 6AM to 12:20PM Adult in room 30; exposure scenario two canisters in room 30

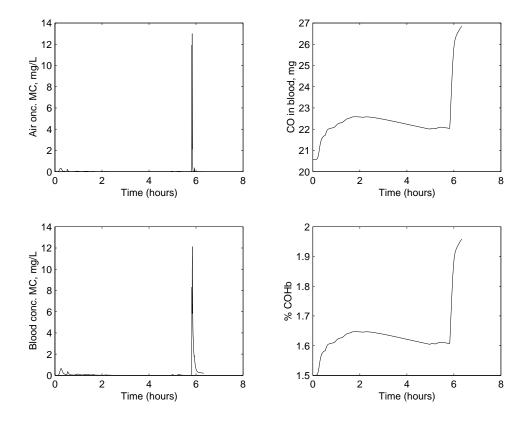
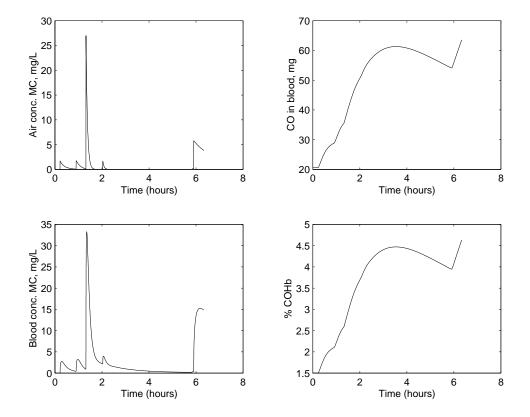


Figure 14 MC air concentration, MC blood concentration, CO in blood and %COHb from 6AM to 12:20PM

Adult moving from Room 19 to Room 27 at 8:30; exposure scenario 1.5 canisters in room 30 and 0.5 in room 27



Appendix C

Physiologically Based Pharmacokinetic Modeling with Dichloromethane, Its Metabolite, Carbon Monoxide, and Blood Carboxyhemoglobin in Rats and Humans

MELVIN E. ANDERSEN,^{2,3} HARVEY J. CLEWELL, III, MICHAEL L. GARGAS,³ MICHAEL G. MACNAUGHTON,⁴ RICHARD H. REITZ,⁸ RICHARD J. NOLAN,⁶ AND MICHAEL J. MCKENNA^{8,5}

Toxic Hazards Division, Armstrong Aerospace Medical Research Laboratory. Wright-Patterson Air Force Base, Ohio 45433-6573: and *1803 Bldg., Dow Chemical USA, Midland, Michigan 48640

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Physiologically Based Pharmacokinetic Modeling with Dichloromethane, Its Metabolite, Carbon Monoxide, and Carbosyhemoglobin in Rats and Humans. ANDERSEN, M. E., CLEWELL, H. J., III. GARGAS, M. L., MACNAUGHTON, M. G., REITZ, R. H., NOLAN, R. J., AND MCKENNA. M. J. (1991). Toxicol. Appl. Pharmacol. 108, 14-27. Dichloromethane (methylene chloride. DCM) and other dihalomethanes are metabolized to carbon monoxide (CO) which reversibly binds hemoglobin and is eliminated by exhalation. We have developed a physiologically based pharmacokinetic (PB-PK) model which describes the kinetics of CO, carboxyhemoglobin (HbCO), and parent dihalomethane, and have applied this model to examine the inhalation kinetics of CO and of DCM in rats and humans. The portion of the model describing CO and HbCO kinetics was adapted from the Coburn-Forster-Kane equation, after modification to include production of CO by DCM oxidation. DCM kinetics and metabolism were described by a generic PB-PK model for volatile chemicals (RAMSEY AND ANDERSEN, Taxicol. Appl. Pharmacol. 73, 159-175. 1984). Physiological and biochemical constants for CO were first estimated by exposing rats to 200 ppm CO for 2 hr and examining the time course of HbCO after cessation of CO exposure. These CO inhalation studies provided estimates of CO diffusing capacity under free breathing and for the Haldane coefficient, the relative equilibrium distribution ratio for hemoglobin between CO and O₅. The CO model was then coupled to a PB-PK model for DCM to predict HbCO time. course behavior during and after DCM exposures in rats. By coupling the models it was possible to estimate the yield of CO from oxidation of DCM. In rats only about 0.7 mol of CO are produced from 1 mol of DCM during oxidation. The combined model adequately represented HbCO and DCM behavior following 4-hr exposures to 200 or 1000 ppm DCM, and HbCO behavior following 1-hr exposure to 5160 ppm DCM or 5000 ppm bromochloromethane. The rat PB-PK model was scaled to predict DCM. HbCO, and CO kinetics in humans exposed either to DCM or to CQ. Three human data sets from the literature were examined: (1) inhalation of CO at 50, 100, 250, and 500 ppm; (2) seven 1-hr inhalation exposures to 50, 100, 250, and 500 ppm DCM; and (3) 2-hr inhalation exposures to 986 ppm DCM. An additional data set from human volunteers exposed to 100 or 350 ppm DCM for 6 hr is reported here for the first time. Endogenous CO production rates and the initial amount of CO in the blood compartment were varied in each study as necessary to give the baseline HbCO value, which varied from less than 0.5% to greater than 2% HbCO. The combined PB-PK model gave a good representation of the observed behavior in all four human studies. This comprehensive model should prove useful for examining coexposures to DCM and CO, for predicting HbCO time courses expected for intermittent exposures to DCM and/or CO, and for developing biological monitoring strategies for these two contaminants based on observed HbCO concentrations after exposure. © 1981 Audenic Press, Inc.

Carbon monoxide (CO) is a ubiquitous air * contaminant derived primarily from incomplete combustion of hydrocarbon fuels. In addition, CO is produced in vivo during the catabolism of heme and during the oxidative metabolism of dihalomethanes except those containing fluorine (Gargas et al., 1986). In the body, CO combines with various hemoproteins and restricts binding of natural ligands such as oxygen. At sufficiently high concentrations, CO acts as a chemical asphyxiant by restricting O2 binding to hemoglobin and interfering with O₂ delivery to body tissues. At the cessation of CO exposure CO is eliminated from the body by exhalation. In this process, free CO in blood diffuses across the alveolar lining and is exhaled. Various physiological factors govern CO pharmacokinetics: endogenous rate of CO production, concentration of CO in inspired air, O2 tension, relative affinity of hemoglobin for CO and O2, and the diffusing capacity of the lung for CO. Coburn, et al. (1965) developed a physiological description of the factors involved in maintenance of blood carboxyhemoglobin (HbCO) in man. The equation which describes the time course of HbCO is called the Coburn-Forster-Kane (CFK) equation and it is of value for restricted applications where most heme is bound with O₂ and endogenous CO production is constant. Peterson and Stewart (1975) subsequently extended the CFK equation to predict HbCO concentrations resulting from CO exposures.

Ramsey and Andersen (1984) described a physiologically based pharmacokinetic (PB-PK) model for the disposition of inhaled volatiles. This model has subsequently been used to examine the kinetic behavior of dichloro-

methane (DCM, methylene chloride) and other dihalomethanes (DHM) (Gargas et al., 1986) and applied in a risk assessment for DCM (Andersen et al., 1987; Reitz et al., 1988). The present work is part of a larger body of research intended to extend the generic PB-PK inhalation model to include analysis of important metabolites. In the case of the dihalomethanes we have modeled the kinetics of CO produced by the oxidation of parent chemicals. This paper outlines the development of a more complete PB-PK model for both CO and blood HbCO which is useful for describing direct CO inhalation, CO produced by endogenous metabolic pathways, and CO produced from dihalomethanes. The CO model was developed following the CFK approach, refined by comparison with HbCO time course data in CO-exposed rats, and scaled to predict human behavior. Predictions in humans were compared to literature data from human volunteers exposed to CO or to DCM and to some human volunteer data presented here for the first time.

METHODS

Rats. Male Fischer 344 rats weighing between 200–250 g were used in all experiments. Rats were maintained on commercially available dry chow and tap water except during periods of exposure when neither food nor water was provided. At all other times rats were kept on a 12-hr light cycle with 40–60% relative humidity.

Exposures. All rat exposures were conducted in 31-liter battery jar-type chambers (Leach, 1963). CO was metered through a flow meter from a pressurized cylinder and mixed with chamber input air. Chamber effluent was directed through a long path length IR cell for continuous monitoring of the chamber effluent. The IR was standardized with known concentration CO atmospheres made up by adding measured volumes of CO to Mylar bags and metering air into the bags from a wet test meter. DCM exposures were conducted in the same chambers. Details of the DCM exposures and chamber analysis of DCM have been reported previously (Gargas et al., 1986).

Blood time course curves. Blood HbCO concentrations were determined spectrophotometrically by the method of Rodkey et al. (1979) using about 5 μ l blood for the assay. Blood DCM concentrations were determined by GC analysis after extracting a 0.1-ml sample of blood with n-hexane. For HbCO determinations, rats were exposed

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² To whom correspondence should be addressed.

³ Present address: CIIT, P.O. Box 12137, Research Triangle Park, NC 27709

⁴ Present address: Southwest Research Institute, 6220 Ciulebra Rd., San Antonio, TX 78228-0510.

⁵ Present address: Park Davis Pharmaceuticals, Ann Arbor, MI.

for 2 hr, removed from the chamber, and bled serially either by repeated tail tipping with a razor blade or from an indwelling jugular cannula. For DCM analysis, larger blood volumes were required and all of these studies were conducted using cannulated rats.

Human studies. The time course data of blood HbCO levels in humans exposed to various concentrations of inhaled CO were obtained from published studies (Stewart, 1975). The data on HbCO, exhaled CO, and blood DCM concentrations in this paper were from studies on human volunteers conducted at the Dow Chemical Co., described below.

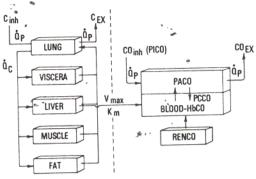
In two well-separated studies (2 weeks) six male human volunteers were exposed to DCM vapors at concentrations of 100 or 350 ppm for a period of 6 hr. At designated intervals, samples of blood and expired air were collected for analysis of DCM (blood and air), HbCO (blood), and CO (air). The collection intervals for expired air were 0.25, 0.5, 1, 1.5, 2, 3, 4, 5, and 6 hr during exposure, and 0.083, 0.25, 0.5, 1, 1.5, 2, 3, 6, 8, 16, and 24 hr postexposure. Collection intervals for blood were 3 and 5 (350 ppm) or 6 (100 ppm) hr after initiation of the exposure (during exposure) and 2, 6, 16, and 24 hr postexposure.

Concentrations of DCM in expired air were analyzed by gas chromatography. Concentrations of DCM in blood were analyzed by direct injection of whole blood (1 μ l) onto gas chromatographic columns with selected ion monitoring (m/e = 84, 86). Concentrations of CO in expired air were measured with a specific electrochemical detector (Ecolyzer CO analyzer, Energetics Science, Almford, NY). HbCO measurements in whole blood were performed with a cooximeter.

Additional human DCM exposure data used in the modeling were from 7.5-hr exposures to various DCM concentrations (Peterson, 1975), and from 2-hr high concentration exposures to DCM (Stewart *et al.*, 1972).

Model development. The modeling approach used was based on the Coburn-Forster-Kane description of the physiological factors which influence HbCO levels in humans (Coburn et al., 1965), with an additional element to account for CO arising from the oxidative metabolism of DCM. In this description all CO is confined to the blood compartment (Fig. 1) where it partitions between two pools-free and bound (i.e., CO and HbCO). Tissue concentrations of DCM were described with the physiological model developed by Ramsey and Andersen (1984), using metabolic constants for DCM metabolism derived by Gargas et al. (1986) for rats or Andersen et al. (1987) for humans (Table 1). The essential elements of the PB-PK model were summarized by Gargas et al. (1986) and are recapitulated in the Appendix. Constants used in the integrated PB-PK model are summarized in Table 1.

Blood compartment. The blood volume was 5.9% of body weight in both rats and humans. Hemoglobin content of blood was 10 mm with respect to heme, a value which is calculated based on an internal erythrocyte heme concentration of about 30 mm. In the equation for the amount



DHM PHYSIOLOGICAL MODEL COBURN-FORSTER-KANE

Fig. 1. Schematic of the physiologically based pharmacokinetic description for dihalomethanes and carbon monoxide. Carbon monoxide (CO) is produced by dichloromethane (DCM) oxidation in the liver and is transferred into the blood. CO also enters blood by endogenous production (REN_{CO}) and by diffusion across alveolar surfaces in response to a partial pressure difference between the alveolar (PAco) and capillary (PCco) tension of CO. Pulmonary transmembrane CO flux is given by the concentration gradient (PACO - PCCO) times the diffusing capacity of the lung for CO (DL). Inhaled partial pressure of CO (PICO) and the ventilation rate (QP) determine the total amount of CO inhaled. Blood CO apportions between free CO and bound CO (carboxyhemoglobin, HbCO). The appendix has a full description of the equations for the combined DHM-CO model.

of CO in the blood compartment at any time there is an initial amount of CO in the blood (AB_{CO} ; eq. 2) which is used to establish a background HbCO at the initiation of exposure. CO enters the blood by DCM oxidation, heme catabolism, and inhalation. A generalized mass balance differential equation for the amount of CO in the blood (AM_{CO}) is

$$\frac{dAM_{CO}}{dt} = REN_{CO} + METAB*P1 + UPTAKE,$$
 (1)

where REN_{CO} is the rate of production of endogenous CO from heme catabolism, METAB is the rate of oxidation of DCM in the body, P1 is an experimentally derived constant giving the yield of CO/mol DCM oxidized, and UPTAKE is the rate of direct uptake/elimination of CO in the lung.

Heme catabolism. The rate of endogenous CO production (REN_{CO}) was adjusted based on the experimental observations to provide an appropriate HbCO background concentration. Based on data of McKenna et al. (personal communication) a background HbCO of 0.7% was used in rats. This was achieved with an AB_{CO} value of 0.117 mg CO/kg body wt and a REN_{CO} of 12 μ g CO/rat/hr. This value for REN_{CO} is higher than that derived experimentally

TABLE 1

PARAMETERS USED IN THE PHYSIOLOGICALLY BASED PHARMACOKINETIC MODEL FOR DICHLOROMETHANE (DCM) AND CARBOXYHEMOGLOBIN (HBCO)

	Human	Rat
Weights	(
Body weight (kg)	83.0	0.22
Liver	3.14%	4.0%
Rapidly perfused organs	3.71%	5.0%
Slowly perfused organs	62.0%	75.0%
Fat	23.0%	7.0%
Blood	5.9%	5.9%
Flows (liters/hr)		
Alveolar vent.	395.0	4.89
Cardiac output	331.0	5.20
Flow distribution (% Cardiac output):		
Liver	24%	20%
Rapidly perfused organs	52%	56%
Slowly perfused organs	19%	15%
Fat	5%	9%
Partition coefficients		
Blood/air	8.94	19.4
Liver/blood	1.46	0.732
Rapidly perfused/blood	0.82	0.732
Slowly perfused/blood	0.82	0.408
Fat/blood	12.4	6.19
Biochemical constants ^b		
V_{maxC} (MFO pathway; mg/hr)	6.25	4.0
K_m (MFO pathway; mg/liter)	0.75	0.4
KFC (GSH pathway; hr-1)	2.00	2.00
Carbon monoxide/HbCO constants D _{LC} , Diffusion coeff.		
(liter/hr/mm Hg) AB _{COC} , Amount background CO	0.058	0.060
(mg)	0.300^{a}	0.117
REN _{COC} , Endog. CO prod		
(mg/hr/kg)	0.15^{a}	0.035
HB _{TOT} , Conc. hemoglobin		
(mm/liter)	10.0	10.0
$M_{\rm mm}$ Haldane coefficient	234	197
P1, CO yield factor	0.71	0.80
F1, CO elimination factor	0.85	1.21
COINH, Background GO levels		
(ppm)	2.2ª	2.2

^a Background levels of CO adjusted in studies of Peterson (78) and Peterson *et al.* (1972). See Figure Legends for details. ^b $V_{\text{max}} = V_{\text{max}C} \cdot (\text{bw})^{0.7}$; KF = KFC · (bw^{-0.3}).

by Rodkey and Collison (1977) of about 4.5 µg CO/rat/hr. DCM metabolism. DCM is metabolized by two pathways only one of which produces CO (Andersen et al., 1987). The equation for DCM consumption in the liver portion of the DCM model includes both oxidative metabolism and DCM conjugation with GSH (Gargas et al., 1986). To account for CO production the mass flux of DCM through the oxidative pathway (METAB) is multiplied by the ratio of the molecular weight of CO to that of DCM. In addition, Gargas et al. (1986) found that only about 70% of the DCM metabolized by microsomal oxidation yields CO, so the constant P1 (Eq. (1)) was set to 0.7 mol of CO produced/mol DCM oxidized in these simulations.

CO inhalation/exhalation. The net flux of CO across the lungs is determined by the concentration difference between the arterial capillary partial pressure of free CO (PC_{CO}) and the partial pressure of CO in alveolar air (PA_{CO}). The amount transferred is determined by the concentration difference (PC_{CO} – PA_{CO}) times $D_{\rm L}$, the diffusing capacity of the lungs for CO, and divided by RHO, the density of CO. Under the conditions in the lungs, RHO is 1102 mg/liter. The value of $D_{\rm L}$ used for the rat, 0.0165 liters CO/hr/mm Hg, is similar to that determined by Takezawa et al. (1980) (0.023) using a single-breath method for estimating diffusing capacity.

CO partitioning in blood. Both O_2 and CO bind reversibly to hemoglobin with their own individual dissociation constants, K_{O_2} and K_{CO} . The ratio of these dissociation constants (K_{O_2}/K_{CO}) is called the Haldane coefficient (M) and can be used to estimate the relative amounts of blood CO which are bound and free for particular concentrations of total heme, O_2 , and CO. In the lung the alveolar capillary O_2 tension is about 100 mm Hg, which corresponds to an O_2 solution concentration of 0.13 mm. The value of M used for rat hemoglobin was 197, consistent with determinations by Allen and Root (1957). This value is M as related to gaseous partial pressures—designated M_{pp} , in this paper.

Computational resources. The physiological model was described by a series of mass balance differential equations plus a number of algebraic relationships. This series of equations was formulated as a computer program and solved numerically with commercially available software packages: either ACSL (Advanced Continuous Simulation Language) or SimuSolv, both of which are commercially available from Mitchell and Gauthier Associates Inc. (73 Junction Square Dr., Concord, MA 01742).

Model scale-up. Ramsey and Andersen (1984) previously described the scale-up process from rodents to humans for styrene. In a similar fashion, blood flows in this model were scaled by body weight to the 0.7 power, while alveolar ventilation was scaled to the 0.74 power of body weight. For these studies, metabolic rates for the oxidative pathways were directly set from experimental data in rats and humans (Andersen et al., 1987). In terms of the model for CO and HbCO, $D_{\rm L}$ was scaled according to Eq. (2):

$$D_{\rm L} = D_{\rm LC} * (BodyWt)^{0.92}$$
. (2)

In this equation D_{LC} is expressed as either ml/min/mm Hg or liter/hr/mm Hg. The exponent of BodyWt used in

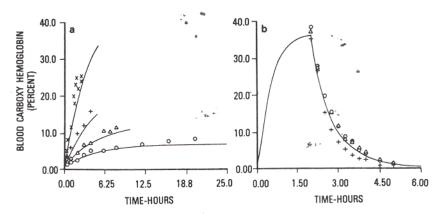


Fig. 2. Blood carboxyhemoglobin concentrations related to carbon monoxide inhalation in human volunteers and in Fisher 344 rats. Human volunteers (a) were exposed to 50, 100, 200, and 500 ppm CO for varying lengths of time. Data (see Stewart *et al.*, 1975) are plotted versus the smooth curve generated from the model. The curves are for 75-kg subjects. (b) Rats were exposed to 500 ppm CO for 2 hr and blood samples were taken serially. Data points are from individual rats (average weight 0.22 kg). In each case physiological parameters were set and the data used to adjust $M_{\rm pp}$ and F1 to give good correspondence between experimental observations and model predictions.

this equation, 0.92, was estimated from a plot of diffusing capacities in rat, guinea pig, cat, rabbit, dog, and man. The value of D_{LC} used for rats, 0.06 liter/hr/mm Hg, gives an estimated D_L value of 0.279 ml/min/mm Hg in a 250g rat, and the value of D_{LC} used for humans, 0.058 1/hr/ mm Hg, gives a D_L value of 48.2 ml/min/mm Hg for a 70-kg human. The value of D_{LC} used for humans is almost twice that used by Coburn, Forster, and Kane (0.03 liters/ hr/mm Hg) and is also higher than that predicted by using the allometric equation reported by Stahl (1967). The higher values of D_L used here were necessary to provide a good description of CO elimination in the rat. An independent determination of D_L was conducted on a 200-g rat, vielding an observed value of 0.17 ml/min/mm Hg (Newton, unpublished experiments, Wright Patterson Air Force Base, OH, 1982) compared to a calculated D_L value of 0.227 ml/min/mm Hg. For the other values, REN_{CO} was scaled to the 0.7 power of body weight while the initial amount of CO in the blood compartment, ABCO, and the blood compartment volume, VBL, were scaled to body weight directly.

RESULTS

CO inhalation/rats. An in vivo inhalation study was performed in which rats were exposed to 200 ppm CO for 2 hr. Experiments conducted for longer periods of time indicated that the HbCO levels had already reached steady-state at 2 hr. Rats were bled serially at

the end of exposure and the percentage of carboxyhemoglobin in blood was plotted for individual animals (Fig. 2b). This study was used to set two constants in the rat model, $M_{\rm pp}$ and F1, which were, respectively, 197 and 1.21 for the rat. The use of an F1 value (Appendix) greater than 1.0 indicated more rapid elimination of CO than expected based on the CFK parameters alone (see Discussion).

DCM inhalation/rats. Andersen et al. (1987) described the time course of DCM in rats following 4-hr exposures to 200 or 1014 ppm DCM. In these same experiments blood HbCO levels were also determined (Fig. 3). Exposure at 1014 ppm DCM (Fig. 3b) produced peak HbCO levels equivalent to those observed with the 200 ppm exposure (Fig. 3a), but the HbCO levels were still near maximum at 1 hr postexposure. Rats were also exposed to a much higher concentration, 5159 ppm, for ½ hr and HbCO levels followed for another 5½ hr (Fig. 4). Peak HbCO levels now occurred at 1-2 hr after the cessation of exposure and were maintained at maximum level until $2\frac{1}{2}$ to 4 hr postexposure. The physiological model accounted for behavior under all of these conditions as shown by the ability of model predictions (smooth lines) to provide good overall

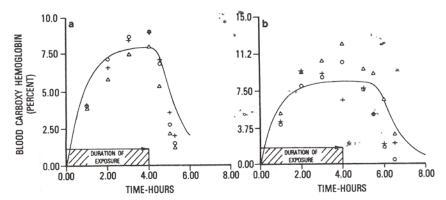


Fig. 3. Blood carboxyhemoglobin (HbCO) concentrations from inhalation of dichloromethane by male Fisher 344 rats. Rats were exposed in groups of three to either (a) 200 ppm or (b) 1014 ppm DCM for 4 hr—represented by the shaded bar. Data are for three rats for each panel bled serially. The maximum metabolic rate ($V_{\rm max}$) for the simulations was 1.46 mg DCM metabolized/rat/hr.

agreement with the shape of the time course curves.

Short duration exposures were also conducted with 5000 ppm bromochloromethane. After adjustment of the metabolic parameters and partition coefficients in the model for this different chemical (see appropriate parameter values in the figure legend), the PB-PK model gave a good description of HbCO levels for up to 6 hr postexposure (Fig. 4) with both of these dihalomethanes.

CO inhalation/humans. The rat physiological model was scaled to represent a 83-kg human (Table 1). The model was run at a variety of inhaled concentrations of CO from 50 to 500 ppm and the output of the model was compared with the HbCO percentages observed by Stewart (1975). As with the rat, the scaled model accurately predicted the kinetic properties of CO combination with hemoglobin (Fig. 2a). These simulations used a F1 value of 0.85 and a value of 0.058 for D_{LC} (Table 1). The M_{pp} value for humans (234) was estimated by multiplying the number used for rats (197) by the ratio of the experimentally determined Haldane coefficients in human blood (230) and in rat blood (190).

DCM inhalation/humans. Andersen et al. (1987) described the fitting of a DCM time course for humans following exposure to 100 or 350 ppm. This data set was developed at

Dow Chemical Co. with human volunteers in 1982. Data obtained in this study are summarized in Table 2 (concentrations of DCM in whole venous blood), Table 3 (concentrations of DCM in exhaled air), Table 4 (concentrations of CO in exhaled air), and Table 5 (percentages of HbCO in whole venous blood).

Simulations of these data are presented in Fig. 5a (DCM in venous blood) and Fig. 5b

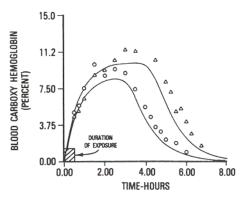


FIG. 4. Blood carboxyhemoglobin levels associated with $\frac{1}{2}$ -hr exposures to 5159 ppm dichloromethane or 5000 ppm bromochloromethane (BCM). Data are the average HbCO levels for three rats after pulse exposure, shown by the shaded bar. Triangles are for BCM; circles are for DCM. With BCM, $V_{\rm max}=2.77$ mg/rat/hr; $P_{\rm b}=41.4$; and $P_{\rm f}=10.0$. With DCM, $V_{\rm max}=1.46$ mg/rat/hr; $P_{\rm b}=19.4$; and $P_{\rm f}=6.1$.

TABLE 2

Concentrations of Methylene Chloride (DCM; μ G/ML) Present in Venous Blood Samples from Human Volunteers Exposed to Either 100 or 350 ppm DCM Vapor for 6 hr

Time (hr)	100 ppm	350 ppm
(Preexposure)	0.005 ± 0.002	0.016 ± 0.008
3	1.11 ± 0.04	5.92 ± 0.53
5	1.05 ± 0.10	5.86 ± 0.49
7	0.15 ± 0.03	0.91 ± 0.22
12	0.062 ± 0.018	0.34 ± 0.12
22	0.012 ± 0.005	0.077 ± 0.039
30	not detected	0.036 ± 0.020

Note. Times in the table are from the beginning of the 6-hr exposure. Unless otherwise indicated, the results are means \pm standard deviation from six subjects.

(ppm DCM in exhaled air). In this same experiment exhaled CO and blood HbCO were determined at various times after exposure. Model simulations and experimental data are presented in Fig. 6a (for ppm exhaled CO) and Fig. 6b (percentage HbCO in venous blood). In each case the scaled model predictions matched the overall shape of the time course curves.

Two other data sets from the literature were examined with the current model. Peterson (1975) exposed volunteers to DCM concentrations of 50 to 500 ppm for 7.5 hr and Stewart *et al.* (1972) exposed volunteers to 986 ppm of DCM for 2 hr. The HbCO levels observed in these studies are presented in Fig. 7a (Peterson, 1975) and Fig. 7b (Stewart *et al.*, 1972). Background HbCO was higher in the Dow study (about 2% HbCO) than in the Peterson study (0.4%) or the Stewart study (about 1.5%). In the model background HbCO levels are adjusted by changing AB_{CO} for time zero HbCO, and REN_{CO} for the steady-state HbCO at times after the cessation of exposure.

All time course curves in Figs. 5a, 5b, 6a, 6b, and 7a were obtained with an allometric oxidation rate ($V_{\rm maxC}$) of 6.25 mg DCM oxidized/hr/kg^{0.7}. In the very high concentration exposures (Fig. 7b) the time course curves for the three individuals show extensive variabil-

ity. The three smooth curves in this figure are obtained with allometric $V_{\rm maxC}$ values of 5.0, 10.0, and 25.0 mg DCM oxidized/hr/kg. This indicates interindividual differences in DCM metabolism. Some of the subjects in this study were using or had been using paint stripping products that contained DCM in their leisure time (personal communication, R. D. Stewart, 1988) which might have caused induction of DCM metabolizing enzymes.

DISCUSSION

Physiological modeling. To the best of our knowledge this work represents the first at-

TABLE 3

CONCENTRATIONS OF METHYLENE CHLORIDE (DCM) AS ppm Present in Exhaled Air in Human Volunteers Exposed to Either 100 or 350 ppm DCM Vapor for 6 hr

	Exposure concentration	
Time		
(hr)	100 ppm	350 ppm
0.25	34.6 ± 5.9	126.3 ± 12.5
0.50	36.4 ± 2.3	141.2 ± 8.3
1.00	39.4 ± 4.7	155.4 ± 8.3
1.50	40.4 ± 5.6	164.9 ± 7.9
2.00	41.2 ± 5.1	175.8 ± 10.1
3.00	41.8 ± 3.1	192.5 ± 10.3
4.00	42.8 ± 3.3	190.3 ± 14.2
5.00	43.3 ± 3.6	192.3 ± 7.1
5.99	45.7 ± 2.8	201.9 ± 12.8
6.083	12.1 ± 0.8	81.3 ± 11.0
6.25	8.5 ± 0.7	58.9 ± 12.1
6.50	6.7 ± 0.9	38.7 ± 7.0
7.00	4.2 ± 1.0	25.1 ± 7.0
7.50	2.7 ± 0.6	17.7 ± 4.1
8.00	2.6 ± 0.4	14.9 ± 3.3
9.00	1.8 ± 0.4	10.3 ± 3.8
10.00	1.4 ± 0.6	8.3 ± 4.0
12.00	nd a	4.5 ± 1.5
14.00	nd a	3.2 ± 1.0
22.00	nd a	1.3 ± 1.0
30.00	nd ^a	nd ^a

Note. Times in the table are from the beginning of the 6-hr exposure. Unless otherwise indicated, the results are means \pm standard deviation from six subjects.

a Not detected.

TABLE 4

CONCENTRATIONS OF CARBON MONOXIDE (ppm) PRESENT IN EXHALED AIR FROM HUMAN VOLUNTEERS EXPOSED TO EITHER 100 OR 350 ppm DCM VAPOR FOR 6 hr

TO!	Exposure co	Exposure concentration	
Time (hr)	100 ppm	350 ppm	
0.00	3.8 ± 0.7	4.2 ± 0.7	
0.25	5.3 ± 0.5	6.5 ± 0.7	
0.50	5.8 ± 0.5	7.6 ± 0.9	
1.00	7.0 ± 0.7	10.5 ± 1.8	
1.50	8.1 ± 0.9	13.3 ± 2.4	
2.00	9.0 ± 0.8	16.1 ± 3.7	
3.00	10.7 ± 1.1	20.9 ± 4.3	
4.00	13.1 ± 1.6	25.9 ± 6.7	
5.00	15.3 ± 2.1	31.1 ± 7.5	
5.99	16.8 ± 1.6	36.1 ± 6.1	
6.083	17.1 ± 1.3	34.6 ± 7.1	
6.25	16.2 ± 1.4	32.5 ± 7.2	
6.50	15.8 ± 1.3	32.6 ± 7.1	
7.00	15.7 ± 0.6	33.3 ± 7.1	
7.50	14.9 ± 1.0	32.3 ± 4.7	
8.00	14.6 ± 0.9	30.9 ± 4.5	
9.00	11.8 ± 0.6	26.8 ± 4.6	
10.00	10.8 ± 0.8	25.1 ± 2.9	
12.00	10.0 ± 0.6	21.2 ± 0.8	
14.00	9.1 ± 0.7	16.9 ± 2.8	
22.00	6.8 ± 0.8	11.8 ± 1.2	
30.00	4.3 ± 0.8	5.6 ± 1.1	

Note. Times in the table are from the beginning of the 6-hr exposure. Unless otherwise indicated, the results are means \pm standard deviation from six subjects.

tempt to provide an integrated physiological pharmacokinetic description of dihalomethane, its metabolite carbon monoxide, and the resulting elevations in HbCO. Gargas et al. (1986) used this same model for analyzing the metabolism of dihalomethanes in vivo and gave a preliminary description of its essential elements. Steady-state characteristics of the model in terms of expected HbCO levels associated with inhalation of various concentrations of DCM were examined in an earlier communication (Andersen, 1981) which also addressed the interspecies extrapolation of results in one species to predict HbCO concentrations expected in another species. This

*present paper is the first detailed description of the CO portion of the combined model, showing its ability to describe existing results for HbCO blood concentrations for both CO inhalation and DCM inhalation in rats and humans.

The development of our combined model followed a relatively straightforward approach. First, the model was developed in its entirety allowing for inhalation of CO, production of CO from DCM oxidation, and endogenous production of CO in the body. This model has many parameters, some of which have been estimated previously by various techniques such as endogenous CO production (Rodkey and Collison, 1977) or the CO diffusing capacity in a breath holding situation (Takezawa et al., 1980). These literature values serve as starting values in the model which was then refined by analyzing in vivo kinetic behavior under conditions where the observed kinetic behavior was essentially determined by just a few of the critical parameters. For instance, the CO inhalation studies are instrumental in setting the Haldane Coefficient, based on

TABLE 5

PERCENTAGES OF HEME PRESENT AS CARBOXYHEMO-GLOBIN (HBCO) IN VENOUS BLOOD SAMPLES FROM HU-MAN VOLUNTEERS EXPOSED TO EITHER 100 OR 350 ppm DCM VAPOR FOR 6 hr

Time (hr)	Expos	Exposure concentration	
	100 ppm	350 ppm	
-0.5	1.50 ± 0.19	1.53 ± 0.21	
3	3.72 ± 0.40	5.30 ± 0.84	
5	5.45 ± 0.42	7.58 ± 1.52	
8	4.63 ± 0.44	9.03 ± 1.16	
12	3.48 ± 0.50	6.52 ± 0.24	
22	2.28 ± 0.44	3.77 ± 0.35	
30	1.83 ± 0.30	1.87 ± 0.39	

Note. Times in the table are from the beginning of the 6 hr-exposure. Unless otherwise indicated, the results are means \pm standard deviation from six subjects. The reading from each subject 0.5 hr before the start of exposure was used as control (i.e., assumed to represent 0% HbCO for each subject).

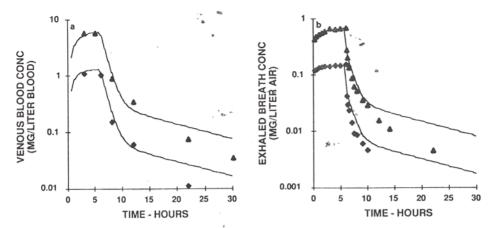


FIG. 5. Human exposure to 50 and 350 ppm dichloromethane: time course of DCM in blood and exhaled breath. Human volunteers were exposed to DCM for 6 hr. Data (Tables 2 and 3) were the average values from six subjects and smooth curves were predicted from the DCM portion of the combined model.

achieved steady-state HbCO, the free breathing CO diffusing capacity, and the adjustment term, F1. In the next step the CO/HbCO module was linked with the PB-PK model for the dihalomethanes. In this way the stoichiometric yield term was estimated—that is the mass flux of oxidation was known from previous gas uptake results (Gargas et al., 1986) and the difference between expected and observed CO production was accounted for by

proposing that only 0.7 mol of CO form per mole of DCM oxidized. Two other parameters, REN_{CO} and AB_{co}, the rate of endogenous CO production and the amount of CO in the blood compartment at time zero, were calculated from the model based on experimental observation of background HbCO in the absence of exposure to DCM or CO.

The goal of the entire model development process was to find a single set of parameters

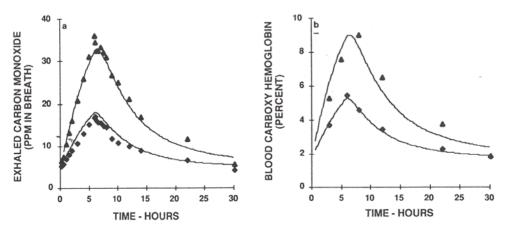


FIG. 6. Human exposure to 50 and 350 ppm dichloromethane: time course of exhaled carbon monoxide and blood carboxyhemoglobin. Exposures are as described in Fig. 5. Data (Tables 4 and 5) are average values from six exposed subjects and the smooth curves were generated from the combined model of DCM and its CO metabolite. The background HbCO of 2% is modeled with $AB_{COC} = 0.30$ mg; $REN_{COC} = 0.15$ mg/hr; and background ambient CO concentration = 2.2 ppm.

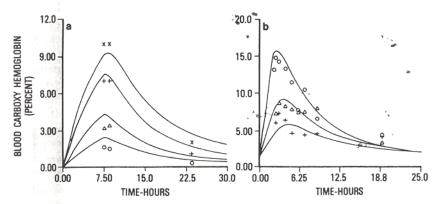


FIG. 7. Blood carboxyhemoglobin in human subjects exposed to dichloromethane. (a) Data from Peterson (1975) for 7.5 hr exposures to 50, 100, 250, or 500 ppm DCM. Data are the average of three observations. (b) Two-hour exposures of individual subjects to 986 ppm DCM (Stewart *et al.*, 1972). The three curves in this panel were generated from three different values of $V_{\rm maxC}$: 5, 10, and 25 mg/kg/hr. In Panel a as with other human simulations, $V_{\rm maxC}$ was 6.25 mg/kg/hr.

(except for REN_{CO} and AB_{CO}) that would provide a representation of all the available kinetic data in the two species. No global fitting procedure was conducted to "estimate" all the numerous parameters. Fitting of these multiparameter models to data is best carried out under conditions where the model behavior is determined by a limited number of parameters, such as in those studies noted previously.

The parameters for the DCM model used in this paper differ slightly from those used in other descriptions of this model (Gargas et al., 1986; Andersen et al., 1987). The body weight of test subjects in our human volunteer studies was 83 kg instead of the value 70 kg (Andersen et al., 1987). The other constants in this present paper represent values that give adequate representations of both parent DCM and its CO and HbCO metabolites. The earlier studies focused on DHM in isolation. Another notable difference is that the models of Gargas et al. (1986) and our present model do not have a separate lung compartment as did that of Andersen et al. (1987). The decision of whether to include a specific organ really is determined by the intended use of the model. The work here only identifies the gas exchange activities and not the xenobiotic metabolizing activities of the lung. Therefore, no formal lung tissue

compartment was deemed necessary in this present work.

With brominated dihalomethanes, another metabolite, the bromide ion itself, was also included in the kinetic model (Gargas et al., 1986). Halide is stoichiometrically produced from each pathway, oxidation and GSH conjugation, and was extremely useful in establishing the individual kinetic constants for these two pathways of DHM metabolism, (Gargas and Andersen, 1982). The present DCM model did not account for chloride ion since it would be difficult to measure this ion against its physiological background concentration. Experiments could be conducted with CH₂³⁶Cl₂ to develop a combined model for DCM, CO, HbCO, and ³⁶chloride ion. This would improve confidence in the choice of the metabolic constants for the two pathways.

The present model should work with all the CO producing DHMs when appropriate values of the kinetic constants and partition coefficients are used (Fig. 7b). Predicted values of HbCO from two different dihalomethanes (Fig. 4) after high concentration exposures were consistent with experimental data.

Another advantage of the combined model is the ability to examine the consequences of

mixed exposure to DCM and elevated CO. At one time, the strategy for setting occupational exposure limits was to keep HbCO less than 5%. Now that DCM has been shown to cause tumors in exposed mice (NTP, 1985), workplace control will probably be related to statistical factors associated with perceived or calculated increased tumor risk (Andersen et al., 1987; Reitz et al., 1988) rather than elevated HbCO.

While the CFK equation handles exponential behaviors at a given concentration of CO, our more complete model is amenable for use with time-dependent changes in inhaled CO. For instance, if work practice analysis provided expected pulsatile CO excursions during the day, these could easily be used as the input function just as time variant DCM concentrations are used to drive the metabolic production of CO in the examples in this present paper.

Model limitations. The CFK description of the factors important for controlling circulating HbCO provides a means to integrate the physiological processes governing CO kinetics. Nevertheless, certain simplifying assumptions were made in this approach. These assumptions make the task of writing the model equations easier but may not be completely accurate.

Two important restrictions are that all CO in the body is in the blood compartment and that the blood compartment from which CO diffuses is an arterial compartment where the hemoglobin is fully liganded. The latter assumption is necessary in order to use the Haldane coefficient for calculating the distribution of heme between the two liganded forms, HbCO and HbO_2 . The partial failure of this latter assumption may be reflected in our modeling by the necessity of incorporating an adjustment term F1 in order to modify excretion rates from those expected on the basis of the physiological processes alone (Table 1).

The parameters used give values for D_L , the diffusing capacity for CO, of almost twice those normally quoted for humans (58 vs 30 ml/min/mm/Hg). The usual method for estimat-

ing D_L , a single-breath, breath holding maneuver, may indeed produce a different estimate than required during free breathing, the condition of the animals and human volunteers described in the experiments with DCM and CO. While several model constants vary from those in the literature by up to a factor of 2 (D_L and indirectly F1), the model is internally consistent and relies on physiological processes that faithfully reproduce combined behavior in both rats and humans.

As to the problem of the single compartment for CO, the question raised is whether there is a deeper compartment which stores significant amounts of ligand and responds differently than the blood compartment. This question cannot be resolved by the present data. However, the model could easily be expanded to include deeper compartments and saturation exposures could be used to examine the behavior of tissue depots with slow time constants. These experiments should be conducted on individual catheterized rats to enhance their power to resolve slow processes. The present experiments do not provide evidence for significant deep stores which would require modification of the one compartment model for CO distribution.

Model results/rats. Rat CO exposures were used to establish certain model parameters $(M_{\rm pp}, F1, \text{ and to a certain extent } D_1)$. These parameters then provide good predictive power for the dihalomethane exposures and the results in humans. At 200 ppm DCM the system is linear (i.e., steady-state HbCO concentrations at 200 ppm are just about twice those observed at 100 ppm) and blood HbCO levels begin to fall immediately at the cessation of exposure. At 1014 ppm DCM the system is saturated (the steady-state HbCO level is virtually unchanged from that at 200 ppm). Now HbCO concentrations remain maximally elevated for a period of time after exposure. This occurs because oxidative metabolism is saturated and blood DCM remains above saturation for over 1 hr postexposure. The blood DCM concentration associated with maximum oxidative rates is estimated by the ratio

of $V_{\rm max}/{\rm QL}$, liver blood flow (see Andersen, 1981). The ratio is about 1.25 mg/liter with DCM. End exposure blood DCM concentration after a 4-hr exposure to 1014 ppm was about 60 mg/liter, well above saturation.

Another situation examined was high concentration pulse exposure (Fig. 4). Blood HbCO continued to rise after the exposure was terminated. Here DCM oxidation is saturated essentially from the initiation of exposure until the time course curves begin to decline at 3-5 hr, depending on the dihalomethane. However, the half-life for filling the blood compartment with CO is about 1 hr, a time longer than the exposure. The combination of slow filling of the blood CO compartment, persistent presence of saturating DHM at the enzyme, and brief pulse exposure produces maximum metabolite concentrations long after the exposure is completed. A variety of factors are involved in maintaining saturation after the exposure: metabolic constants for DHM oxidation, blood flow to metabolizing organs, blood/air partition coefficients, and fat/blood partition coefficients. The latter is an important parameter since the fat can act as a depot slowly redistributing chemical as blood concentrations fall. The more prolonged elevation of blood HbCO with CH2BrCl as compared to DCM (CH2Cl2) is associated with several parameters—higher blood/air partition coefficient, higher fat/air partition coefficient, and lower pulmonary clearance (related to the blood/air partition coefficient) for BCM. Values of these parameters can be found in the legend to Fig. 7b.

Model results/humans. The human model required a value of F1 less than 1.0 for satisfactory description of the experimental data. The predicted behavior agreed with observed results except that the background HbCO in the present experiments had to be set to a larger value (about 2%) than consistent with expected values for nonsmokers. It is not clear whether our experimental subjects had an input of CO to maintain higher levels of HbCO or if there was a measurement artifact in determining background concentration. Since

HbCO and exhaled CO were both elevated and since both were determined by very different techniques, the increases appear to be real. It deserves mention that the rat model was not developed by examining exhaled CO, yet the PB-PK analysis readily allowed prediction of this parameter for the human exposures.

DCM is a primary constituent of many paint stripping formulations. The production of CO during DCM metabolism was first observed in human studies, not in metabolism studies with experimental animals. Nonsmoking human volunteers were taking part in a controlled study of CO exposures. A participant in the study who had markedly elevated background HbCO was found to be using a DCM paint stripper in the evening before controlled exposure to CO. Increased blood HbCO on the morning after avocational use of DCM is consistent with the kinetics of HbCO seen in rats after a brief pulse exposure to DCM (Fig. 4). Expected behavior in a human was simulated for a 3-hr pulse exposure to 2000 ppm (not shown). Here the peak HbCO level (8%) occurs 8 hr after the exposure. Our model could easily be used to interpret biological monitoring results with blood HbCO. For instance, given an observed HbCO at a particular time after cessation of a DHM exposure of particular duration, the TWA-exposure concentration required to produce the observed level of HbCO could be readily calculated.

Summary remarks. A combined PB-PK model has been developed to predict DCM, HbCO, and exhaled CO concentrations in both rat and humans by several routes of administration. This contribution focused on inhalation exposures but the model has also been used to examine intravenous dosing and oral gavage studies with DCM (Andersen et al., 1984). While the purpose of this effort was to combine the DHM and CO descriptions, the model is a complete description of CO behavior and its main utility in the future may well be examining expected HbCO burdens arising from complex occupational CO exposure scenarios.

APPENDIX

The mass balance differential equation for the amount of CO in the blood compartment consists of three distinct terms:

$$\frac{dAM_{CO}}{dt} = REN_{CO} + \frac{V_{max} * C_{VL} * MW_{CO} * P1}{(K_m + C_{VL}) * MW_{DCM}} - D_L * (PC_{CO} - PA_{CO}) * RHO. (1)$$

RENCO is the endogenous rate of CO production (mg/hr); C_{VL} is the liver venous concentration of DHM from the PB-PK inhalation model (mg/liter); V_{max} (mg/hr) and K_m (mg/ liter) are kinetic constants of the oxidative pathway; MW_{CO} and MW_{DCM} are the molecular weights of CO and DCM, respectively; and P1 is the portion of the oxidative pathway that yields CO. D_L is the diffusing capacity of the lung for CO (liter/hr/mm Hg); PCCO and PA_{CO} are, respectively, the CO partial pressures in arterial capillary blood and alveolar air (mm Hg); and RHO is the density of CO at 37°C (mg/liter). In the integral, ABCO, the constant of integration, is the amount of CO in the blood compartment at the initiation of exposure.

$$AM_{CO} = \int_0^t \frac{dAM_{CO}}{dt} + AB_{CO}.$$
 (2)

The total amount of CO in the blood in milligrams, Eq. (2), is apportioned between bound CO (i.e., HbCO) and free CO, equivalent to PC_{CO} in the CFK nomenclature. From the definition of the Haldane coefficient in terms of millimolar concentrations of CO in solution,

$$(CO_{free}) = \frac{(O_{2_{free}})(HbCO)}{(M_{mm})(HbCO)}.$$
 (3)

In the blood we have conservation equations for both total carbon monoxide and total hemoglobin. They are

$$AM_{CO}(mg) = ((CO_{free}) + (HbCO))$$

$$*V_{BL}*MW_{CO} \quad (4)$$

$*$
 Hb_{TOT}(mM) = (HbO₂) + (HbCO). (5)

Substituting for CO_{free} and HbO₂ in Eq. (3) produces a relationship for the concentration of carboxyhemoglobin based on the amount of carbon monoxide at any time:

(HbCO) =
$$\frac{AM_{CO}/(V_{BL}*MW_{CO})}{(1 + O_{2_{free}})/(Hb_{TOT} - HbCO)}. (6)$$

Equation (6) could be expressed as a quadratic in (HbCO). In our implementation, it was solved implicitly during the integration. With (HbCO) known, (CO_{free}) and the percentage of carboxyhemoglobin (HbCOPC) are readily calculated.

In the literature the Haldane coefficient is given in terms of partial pressures of O_2 and CO in the gas phase, i.e., M_{pp} . The conversion between the Haldane coefficients based on partial pressure and solution concentration is

$$M_{\rm mm} = M_{\rm pp} * \frac{\rm SOL_{0_2}}{\rm SOL_{CO}} * \frac{\rm MW_{CO}}{\rm MW_{O_2}}$$

= 1.313 $M_{\rm pp}$ (7)

$$D_{L}*(PC_{CO} - PA_{CO})$$

= $QP*\frac{(PA_{CO} - PI_{CO})}{P_{AIR}}$. (8)

Equation (8) gives the two conservation equations for CO in the system stating that the amount crossing the alveolar membrane is equivalent to that net amount retained from inhaled air.

In this equation, PI_{CO} is the inspired CO pressure, P_{AIR} is the atmospheric pressure minus the pressure of water vapor at 37°C (713 mm Hg) and QP is the alveolar ventilation rate (liters/hr). The value used for QP is the same in both the inhalation PB -PK model for DCM and the CFK model for the inhalation and exhalation of CO. This equation can be rearranged to solve for PA_{CO} :

$$PA_{CO} = \frac{PC_{CO} + PI_{CO}(QP)/D_{L}/P_{AIR}}{1 + QP/D_{L}/P_{AIR}}.$$
 (9)

 PC_{CO} is known by difference from Eq. (4) and PA_{CO} can be calculated directly. The final equations for CO elimination then are

$$CO_{Elim} = D_L * RHO * (PC_{CO})$$

$$- PA_{CO})*F1.$$
 (10)

The exhaled concentration of CO, CO_{EXH}, was calculated by assuming the pulmonary ventilation was two-thirds of total ventilation.

$$CO_{EXH} = \frac{2}{3} * (CO_{Elim})/QP.$$
 (11)

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Appendix D

Co-Editor in Chief Lucier Retires

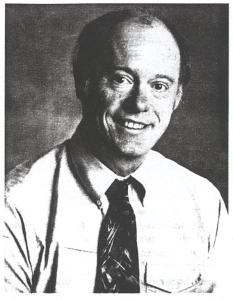
Public service. It's a term that has fallen into disregard in recent years as cynicism has replaced optimism about so-called government work and those who do it. Yet there are those who have chosen to follow the ideal of public service espoused by John F. Kennedy when he said "[A]sk not what your country can do for you, ask what you can do for your country." One of these people is George W. Lucier, an environmental health research pioneer and coeditor in chief of this journal for the past 28

years. In 1970, Lucier chose to devote his intellectual talents to a career in science at a federal research institution, the NIEHS. What developed over the next 30 years of his career was a series of contributions to public health that reached beyond national boundaries. At the end of June, Lucier officially retired from his position as director of the Environmental Toxicology Program, the NIEHS program that executes the work of the National Toxicology Program (NTP), and as co-editor in chief of *EHP*. But the consequences of his leadership and life's work continue to be felt far beyond the epicenter of his career.

Lucier began his career by helping to mold basic science into tools for solving the complex problems created by an industrial society's impact on the natural world and human health. This work has been concentrated most significantly in two areas: the establishment of research models that use molecular epidemiology to obtain better measures of exposure to environmental agents and the use of receptor-mediated toxicology in understanding low-dose effects of chemicals.

In the early 1980s, Lucier began to examine the way that epidemiology was used to formulate estimates of exposure. His early research in the areas of benzene, polycyclic aromatic hydrocarbons, and dioxins formed the basis for new research models that have been accepted by scientists around the world. These models, which bring the tools of molecular epidemiology to bear on the process of human sampling and biochemical analysis of such samples to create better indications of human exposure to toxic substances, have become a benchmark for determining how animals and people respond to environmental insult. Consequently, this information is now commonly used to form the basis for human risk assessment and regulatory decisionmaking.

In the 1990s, Lucier continued to expand the scientific basis for risk assessment when he joined efforts with NIEHS biomathematician Chris Portier to transform science's understanding of receptor-mediated toxicology. Prior to this, chemical risk assessments were almost universally based on overly simplistic threshold or linear dose-response models. Lucier and Portier used their knowledge of the mechanisms of action of dioxins and environmental estrogens to develop laboratory strategies for understanding the low-dose effects of these, and subsequently other chemicals. This understanding of low-dose effects has revolutionized the way that scientists, regulatory agencies, and the public have come to view the dangers of toxic chemicals and other environmental agents. In particular, the mechanistic approach has been utilized through Lucier's involvement in an almost eight-year process by the U.S. Environmental Protection Agency to reevaluate the risk of human exposure to dioxin. This review, which is nearing completion, produced credible biologically



based models for estimating risk and will doubtless be used as a model for determining the hazards posed by other agents.

In recent years, Lucier's attention has been focused precisely on this problem of evaluating chemical and environmental agents for their effects on human health. In 1993, he assumed the directorship of the NIEHS Environmental Toxicology Program and began to transform the NTP from a program focused almost exclusively

on traditional carcinogenicity and toxicity tests to one that sets the gold standard for toxicity evaluation by combining animal data with mechanistic approaches to evaluating human exposures. His mantra and that of the NTP became "good science for good decisions."

Recognizing that the purpose of the NTP is to serve public health, Lucier set about creating a framework for decisionmaking that incorporates multiple stakeholders including state and federal scientific and public health agencies, industry, and public interest and environmental organizations into the process with a focus on the consideration of a variety of inputs, open communication, and public accountability for both the process and the final decisions that are made as a result. His recognition that government-funded science cannot operate in isolation but must be shown to be appropriate, justified, and responsive to public health priorities has taken the NTP from a largely parochial program based at the NIEHS to a truly national endeavor toward solving major environmental health questions. Ways in which this is being accomplished include the establishment of NTP centers for the evaluation of reproductive risks, the validation of alternative test methods in toxicology, and the investigation of phototoxicology.

In turn, Lucier has taken the approaches developed in the NTP and applied them to major global health issues as well. For example, his work on a World Trade Organization scientific panel on the potential health effects of growth promoters in livestock helped to set a precedent for the use of health risk assessments in making international trade decisions. And his skills as a scientist, a negotiator, and a consensus-builder were used to ultimate advantage in brokering a level of agreement among various federal agencies over what are considered safe levels of methylmercury in our environment.

In conjunction with the multitude of his other duties, Lucier helped to lead *EHP* in its evolution from a series of monographs into a truly global science journal devoted to promoting environmental health through the communication of credible, timely, and understandable research and information.

Perhaps Lucier's greatest achievement, however, has been his ability over the years to inspire those who have had the opportunity to work with him and witness his devotion to public health to take up the mantle of public service themselves, to the betterment of the planet and all its people.

Kimberly G. Thigpen News Editor, EHP Environmental health is a discipline that can stimulate our best instincts to be considerate of all people and creatures on this planet.

Parting Thoughts

It has been said that there is no stronger urge than the urge to edit someone else's writing. Upon my retirement from the National Institute of Environmental Health Sciences (NIEHS), and concurrently from my position as co-editor-in-chief of Environmental Health Perspectives, I find that perhaps the stronger urge is not to edit but rather to editorialize. Therefore, I would like to provide some parting thoughts, and with them hopefully some insights gained from my experiences, which have spanned the broad spectrum of environmental-health, from basic science to public health policy to science communication. In a 30-year career in environmental health, I have witnessed the expansion of the field as both a scientific discipline and a global movement. In looking forward, I feel that there are some major components which environmental health must enthusiastically encompass if it is to continue to provide real answers to some of the most pressing issues of our day.

Mechanism-based toxicology must be the centerpiece of any effective strategy for meeting the challenges of providing the public with better answers to complex public health questions. Clearly, the controversies that surround dose—response relationships, selection of appropriate models for extrapolating human responses to environmental insult, and the factors that are responsible for interindividual variations in susceptibility to adverse health effects can only be addressed if we make appropriate use of new technologies and our exploding knowledge of fundamental biologic processes. Yet, we should not become unthinking and arrogant slaves to the technology itself. Instead, we must employ sound scientific judgment in asking the right questions and in interpreting the results in a credible fashion.

As part of this process, we must continue to lessen our use of animals in environmental health research. The impressive development of cell-based toxicology systems offers the opportunity to achieve a panel of toxicity tests that are faster, more sensitive, more specific, and cheaper than existing long-term bioassays in rodents or other species for assessing cancer and other effects. Although I agree that we must seize this opportunity to diminish our reliance on animal bioassays, I expect that decreased animal usage will be gradual and will continue into the foreseeable future if we are to meet our mandates of public health protection.

Just as we look to the common physiologies of people and animals for health answers, so should we look to the common ground between human and ecologic health. We often drift away from the concept of the connections between humans and their total environment, and, in doing so, we inappropriately narrow our perspective. Most of the major environmental health issues of our day, including global warming, endocrine disruptors, the causes of malformed frogs, and toxic organisms such as Pfisteria emphasize the need to seek and define this common ground in our research strategies and in our health policy decisions.

With these goals comes the inevitable realization that resources of all types—time, money, and humans—are limited and thus, priorities must be set. It has been said that you can have it all, just not at the same time, and I believe this to be true. What this means is that we have to choose well in setting environmental health priorities if we are to make the best uses of the resources available to us. This is often

an extremely difficult task. For example, setting testing priorities for the National Toxicology Program (NTP) presents a host of challenges; there are 80,000 chemicals in commerce today, many of which have not undergone adequate toxicologic evaluation. The question is, of course, where to begin. Among our top priorities for toxicologic evaluation, we must include DNA-based products, herbal medicines, chemical mixtures, and phototoxicity.

In performing such evaluations, as with all environmental health research, we must adopt a multidisciplinary approach to research. Many times the invocation to multidisciplinary research is often merely rhetoric and does not represent a true desire to understand a different perspective. My hope is that the critical environmental issues of our day will foster effective interactions among disciplines and that all stakeholders, be they basic scientists, toxicologists, mathematicians, epidemiologists, risk assessors, ecologists, public health officials, or public citizens, will work together to achieve environmental health gains. To do this we must always strive for objectivity, work toward consensus, never disdain negotiation, and acquire an understanding of the diverse points of view that surround environmental health issues.

Preparation for these efforts requires training. Such training poses unique challenges because of the extraordinarily broad scope of activities and disciplines housed under the umbrella of environmental health research. However, progress in such research and its linkage to public health policy demands a significant and sustained training effort by the NIEHS and other federal agencies. Senior scientists and managers must take their mentoring responsibilities seriously and provide to their employees real opportunities to learn in an atmosphere that fosters creativity, goodwill, and a sense of service.

This is especially true for those who work for public scientific agencies and organizations. We must remember who pays our salaries and funds our research, and guard against becoming nonresponsive to public concerns over environmental and health issues. We must remember that the public has a right to know, and we have an obligation to provide understandable information on what we do, why we do it, and what we think it means; and to listen and change what we do when called upon by our "real bosses." Environmental health institutions must recognize that communication is a two-way street, best served by effective interactions throughout an entire process be it regulatory decision making or formulation of scientific strategies, not just the reporting of a decision at the end. To facilitate this process, journals such as *EHP* have an obligation to provide accurate and understandable information on important issues in a timely manner.

In making the decision to come to the NIEHS and to stay here for 30 years, I have been privileged to work with those at the NIEHS, as well as many agencies, organizations, and institutions in the United States and abroad, on the common goals of global human health and a healthy environment. As my final parting thought, I would like to thank the dedicated, talented, and hard-working people who have made environmental health a discipline that can stimulate our best instincts to be considerate of all people and creatures on this planet.

George W. Lucier Co-Editor-in-Chief, *EHP*

09/02/99

CURRICULUM VITAE

Name: George Wayne Lucier

Date and Place of Birth: June 23, 1943, Southbridge, Massachusetts

<u>Citizenship</u>: United States

Education:

June 1961 -	Graduated from High School
June 1965 -	B.A. (Biology), Clark University, Worcester, Massachusetts
Feb. 1968 -	M.S. (Entomology), School of Agriculture, University of Maryland
June 1970 -	Ph.D. (Entomology), School of Agriculture, University of Maryland

Brief Chronology of Employment:

1965 - 1970	Graduate Assistant, Department of Entomology, University of Maryland
1970 - Date	National Institute of Environmental Health Sciences, Research Triangle
	Park, North Carolina
1970 - 1972	Staff Fellow
1972 - 1974	Senior Staff Fellow
1974 - Date	Research Chemist
1979 - 1980	Acting Chief, Laboratory of Organ Function and Toxicology
1981 - 1984	Head, Section on Receptor Pharmacology, Laboratory of Pharmacology
1984 - 1996	Chief, Laboratory of Biochemical Risk Analysis, Division of Intramural
	Research
1993 - Date	Director, Environmental Toxicology Program, National Institute of
	Environmental Health Sciences Senior Executive Service

Bio Sketch

Dr. George W. Lucier is Director, Environmental Toxicology Program, at the National Institute of Environmental Health Sciences (NIEHS) and in that capacity is establishing new directions for the National Toxicology Program, the nation's most comprehensive toxicology testing program. He also serves as Chairman of the Scientific Advisory Board for regulation of toxic air pollutants by the State of North Carolina. Dr. Lucier has been a researcher at NIEHS since 1970, and his research group focuses on molecular epidemiology and dosimetry. His recent work is attempting to use fundamental knowledge to reduce uncertainty in risk estimates of endocrine disrupting chemicals. He is widely recognized for his work in the areas of steroid action, mechanisms of dioxin toxicity, and xenobiotic metabolism, and has published more than 200 articles in these areas. During the last 10 years, he has helped to forge the emerging areas of molecular

epidemiology and the development of laboratory approaches to improve the risk assessment process and in this capacity, he frequently advises Federal and state agencies on high visibility human health risk assessments. He received his Ph.D. from the School of Agriculture, University of Maryland, College Park. He also serves as Co-Editor-in-Chief of Environmental Health Perspectives.

Editorial Responsibilities:

1973 - Date Co-Editor, <u>Environmental Health Perspectives</u>, National Institute of

Environmental Health Sciences

Societies:

American Society for Pharmacology and Experimental Therapeutics

Society of Toxicology

American Association for the Advancement of Science

Endocrine Society

American Association for Cancer Research

Major Awards:

NIH Director's Award for research excellence in perinatal aspects of toxicology, pharmacokinetics and enzymology, June 1978.

NIH Award of Merit for Scientific Excellence, 1986.

Outstanding Performance Awards - 1990, 1991, 1992, 1993, 1994. 1995, 1996

Senior Executive Service Performance Awards – 1997, 1998

NIH Director's Award for developing partnerships in environmental health and risk assessment, June 1997.

Academic Activities:

Adjunct Faculty Member, University of North Carolina, Department of Biochemistry and Nutrition, 1977 - Date

Faculty Member, University of North Carolina Curriculum in Toxicology (Ph.D. Granting Program) and University of North Carolina Toxicology Training Program, 1980 - Date

Doctoral Dissertation Committee, Dr. Winifred Curley, University of North Carolina, Department of Biochemistry and Nutrition (Ph.D. awarded 1983)

Doctoral Dissertation Advisor and Chairman of Dissertation Committee, Dr. Claudia Libman Thompson, University of North Carolina, Department of Biochemistry and Nutrition, 1978 - 1982 (Ph.D. awarded May, 1982)

Academic Activities: (continued)

Doctoral Dissertation Advisor and Chairman of Dissertation Committee, Dr. Diane Campen, University of North Carolina, Curriculum in Toxicology, 1982 - 1988 (Ph.D. Awarded, 1988)

- Doctoral Dissertation Advisor and Chairman of Dissertation Committee, Dr. Tamra Goodrow, University of North Carolina, Curriculum in Toxicology, 1986 - 1989 (Ph.D. Awarded, 1989)
- Doctoral Dissertation Committee, Dr. James Conway, University of North Carolina, Curriculum in Toxicology, 1981 1984 (Ph.D. awarded 1984)
- Doctoral Dissertation Committee, Dr. Jane Gallagher, University of North Carolina, School of Public Health, 1984 (Ph.D. awarded, 1986)
- Doctoral Dissertation Committee, Dr. Susan Borghoff, University of North Carolina, School of Public Health, 1984 1987 (Ph.D. awarded, 1987)
- Doctoral Dissertation Committee, Dr. Dennis Chapman, University of North Carolina, Curriculum in Toxicology, 1985 1988 (Ph.D. awarded, 1987)
- Doctoral Dissertation Advisor and Chairman of Dissertation Committee, Dr. Jay Goldring, University of North Carolina, Curriculum in Toxicology, 1987 1990 (Ph.D. awarded, 1990)
- Doctoral Dissertation Committee, Dr. Beth Mileson, University of North Carolina, Curriculum in Toxicology, 1987 1989 (Ph.D. awarded, 1989)
- Doctoral Dissertation Advisor and Chairman of Dissertation Committee, Dr. Charles H. Sewall, University of North Carolina, Curriculum in Toxicology, 1991 1994 (Ph.D. awarded, 1994).
- Biochemical Toxicology Course; Lectures on Teratology, Toxicokinetics, Toxicant-Receptor Interactions, Conjugation Reactions, Physiological Factors Affecting Metabolism and Biochemical Risk Assessment, University of North Carolina, Department of Biochemistry and Nutrition (Graduate School), 1979 Date
- Chairman, Grant Proposal Review Committee for Dr. Will Harrelson, University of North Carolina, Department of Biochemistry and Nutrition, 1982
- Introduction to Research in Biochemistry Course, University of North Carolina, Department of Biochemistry and Nutrition, 1978 Date
- Chairman, Written Exam Committee for Graduate Students, University of North Carolina Curriculum in Toxicology, 1984.
- Executive Committee, University of North Carolina Curriculum in Toxicology, 1984 1987.
- Doctoral Dissertation Advisor and Chairman of Dissertation Committee, Mr. Michael Wyde, University of North Carolina, Curriculum in Toxicology, 1998 Date.
- Doctoral Dissertation Advisor, Ms. Amy Kim, University of North Carolina, Curriculum in Toxicology, 1998 Date.

<u>Invited Seminars, Presentations, Symposia</u>: (1988 - Date)

Seminar to Worcester Foundation for Experimental Biology, "Molecular Approaches in Epidemiology and Risk Assessment", March, 1988.

Co-Organizer of Symposium on "Benzene Metabolism Toxicity and Carcinogenesis, Research Triangle Park, March, 1988.

Seminar to Texas A and M University, Department of Pharmacology, "Placental Markers of Human Exposure to Environmental Chemicals", April, 1988.

Presentation to American Chemical Society Symposium on Biological Markers of Environmental Contaminants "Placental and Lymphocyte Markers of Human Exposure to PCBs and PCDFs, Los Angeles, California, September, 1988.

Panel presentation to Workshop on "Interspecies Extrapolation" sponsored by the American Board of Toxicology and Society of Risk Analysis, October, 1988.

Presentation to Symposium on Assessment of Inhalation Hazards: Integration and Extrapolation Using Diverse Data "Molecular Dosimetry in Risk Assessment", Hannover, Federal Republic of Germany, February, 1989.

Presentation to Workshop on Experimental and Epidemiologic Applications to Risk Assessment of Complex Mixtures "Placental Markers of Human Exposure to PCBs and PCDFs, Espoo, Finland, May, 1989.

Presentation to Gordon Conference on Toxicology "Interactions of TCDD with Receptors", Kimball Union, New Hampshire, July, 1989.

Presentation to International Life Sciences Institute Regional Risk Assessment Workshop, "Overview of Biomarkers", Chicago, Illinois, June 1989.

Presentation to NIH Workshop on Hormonal Carcinogenesis, "Liver Models of Estrogen Induced Carcinogenesis", Gaithersburg, Maryland, September, 1989.

Presentation to SETAC symposium on Long-Term Effects of Bioaccumulated Polyhalogenated-Hydrocarbons, "Placental Markers of Human Exposure to PCBs and PCDFs: Implications for Risk Assessment", Toronto, Canada, October, 1989.

Presentation to NIH workshop on Human Health Effects of Halogenated Biphenyls and Related Compounds, "Effects of Halogenated Aromatics on Multiple Receptor Systems in Animal Models and Human Tissues", Ann Arbor, Michigan, November, 1989.

<u>Invited Seminars, Presentations, Symposia</u>: (continued)

Presentation to Society of Toxicology Symposium on Comparative Dosimetry of Inhaled Materials: Differences Among Animal Species and Extrapolation to Man, "Biomarkers of Dose of Inhalants", Miami, Florida, February, 1990.

Presentation to Symposium on Application of Molecular Markers in Epidemiology, "Relationships Between Various Markers of Genetic Damage in Blood Cells", Research Triangle Park, North Carolina, February, 1990.

Seminar to N.C. State University, "Interactions of TCDD and its Structural Analogs with Multiple Receptor Systems", Raleigh, North Carolina, April, 1990.

Seminar to Chemical Industry Institute for Toxicology, "Role of Estrogens in Promotion of Liver Tumors by TCDD in Rats, Research Triangle Park, North Carolina, June, 1990.

Discussant to Third International Conference on the Use of Human Cell, Tissues and Organs in Research", Washington, D.C., September, 1990.

Seminar to Washington State University Pharmacology Department on "Ovarian Hormones are Essential for TCDD Hepatocarcinogenicity," Pullman, Washington, September, 1990.

Presentation to Banbury Conference on the Biological Basis for Risk Assessment of Dioxin and Related Compounds, "Dioxin and tumor promotion", Cold Spring Harbor, NY., October, 1990.

Presentation to Society for Risk Analysis "Animal Studies on TCDD and Related Compounds: Toxic and Biochemical Effects", New Orleans, Louisiana, October, 1990.

Presentation to Society of Toxicology Symposium on "Assessment of Exposure to Pulmonary Toxicants: Use of Biological Markers", Dallas, Texas, February, 1991

Presentation to Conference on Hormonal Carcinogenesis, "Issues on Risk Assessment", Cancun, Mexico, March, 1991.

Co-organizer, Dioxin 91 Conference, Research Triangle Park, September 1991. Presented conference summary on integration of biological data in risk assessment and paper on animal cancer.

Presentation to the American Cancer Society's Mary Lasker Conference on Molecular Epidemiology of Risk Assessment entitled, "Will Biomarkers Lead Us Out of the Wilderness," Sarasota, Florida, April 3-5, 1991.

<u>Invited Seminars, Presentations, Symposia</u>: (continued)

Presentation to the Eighth Health Effects Institute Annual Conference on, "Animal Models for Cancer and Human Risk: Potential Role of Biomarkers," Colorado Springs, Colorado, April 21-24, 1991.

Participant in IARC Workshop on Use of Data on Mechanisms of Carcinogenesis in Risk Identification. Prepared background paper on "Receptor-Mediated Carcinogenesis" and Chaired Working Group on Mechanisms. Lyon, France, June 11-18, 1991.

Speaker and Chairperson at IARC meeting on "Biomonitoring and Susceptibility Markers in Human Cancer: Applications in Molecular Epidemiology and Risk Assessment," Kailua-Kona, Hawaii, October 27 - November 2, 1991.

Presentation to Society of Risk Analysis Symposium on Dioxin Risk Assessment. Presentation entitled, "Relevance of Animal Data to Human Responses," Baltimore, Maryland, December 9, 1991.

Presentation to ILSI Seminar Series at the Brookings Institution entitled, "Dose-Response Relationships for Dioxin's Effects," Washington, D.C., March 19, 1992.

Presentation to Symposium on Incorporating Molecular Mechanisms into Estimates of Cancer Risk. Presentation entitled, "Dose-Response Relationships for Dioxin in a Rat Liver Tumor Promotion Model: Implications for Risk Assessment." University of Connecticut, Storrs, Connecticut, April 23-24, 1992.

Presentation to EPA Open Meeting on Reevaluation of Dioxin's Risks. Presentation entitled, "Dose-Response Models for Dioxin's Effects," Washington, D.C., April 28, 1992.

Plenary Presentation to Dioxin '92 Symposium, "Receptor-Mediated Responses and Dioxin Toxicity." Tampere, Finland, August 23-27, 1992.

Presentations to EPA Peer Review Panel for Reevaluation of Dioxin's Risks. Presentations entitled, "Carcinogenesis in Experimental Animals," and "Dose Response Models for Dioxin's Effects," Washington, D.C., September 22-24, 1992.

Seminar to Rutgers University and Robert Wood Johnson Medical School entitled, "Dose Response Relationships for Dioxin's Effects," Piscataway, New Jersey, October 22, 1992.

Presentation to US-Italy Symposium on Molecular Epidemiology. Presentation entitled, "Lab Studies of dioxin and Cancer Risks: Implications for Risk Assessment," Genoa, Italy, November 2-3, 1992.

<u>Invited Seminars, Presentations, Symposia</u>: (continued)

Seminar to University of Milan entitled, "The Ah Receptor and Dioxin: Human and Animal Data", Milan, Italy, November 6, 1992.

Presentation to Toxicology Forum on Current Views on the Impact of Dioxins and Furans on Human Health and the Environment. Presentation entitled, "Hormonal Influences on Tumor Induction," Berlin, Germany, November 9-11, 1992.

Presentation to Washington, D.C. Society of Toxicology Symposium. Presentation entitled, "Dose Response Relationships for Dioxin's Effects," Washington, D.C., December 3, 1992.

Presentation to Conference on Receptor-mediated Biological Processes: Implications for Evaluating Carcinogens. Presentation entitled, "Receptor-mediated Responses: Estrogens, Dioxins, and Interactions," Barton Creek, Texas, December 8-11, 1992.

Presentation to Society of Toxicology Symposium on Hormonal Carcinogenesis: Challenges for Future Research. Presentation entitled, "Receptor-mediated Carcinogenesis," New Orleans, Louisiana, March 14-18, 1993.

Presentation to Symposium on Human Tissue Monitoring and Specimen Banking. Presentation entitled, "Choice of Bankable Tissues for Evaluating Intra and Interindividual Variation," Research Triangle Park, North Carolina, March 30-31, 1993.

Presentation to International Congress on the Health Effects of Hazardous Wastes. Presentation entitled, "Molecular Epidemiologic Approaches to Assessing Public Health Impacts of Hazardous Wastes," Atlanta, Georgia, May 3-6, 1993.

Presentation to International Congress on the Health Effects of Hazardous Wastes. Presentation entitled, "Receptor Mechanisms and Risk Assessment," Atlanta, Georgia, May 3-6, 1993.

Presentation to International Congress on Toxic Combustion By-products. Presentation entitled, "Molecular Dosimetry of Environmental Carcinogens," Cambridge, Massachusetts, June 14-16, 1993.

Presentation to Gordon Research Conference on Hormonal Carcinogenesis. Presentation entitled, "Risk Assessment of Receptor-mediated Carcinogens," Salve Regina College, Newport Rhode Island, August 8-13, 1993.

Symposium on "Breast Cancer and the Environment: What We Know, What We don't Know, What We Need to Know," Chairman, Workgroup on Identification of Breast Carcinogens, Adelphi University, Garden City, New York, November 15-16, 1993.

<u>Invited Seminars, Presentations, Symposia</u>: (continued)

Presentation to AACR Conference on Risk Assessment in Environmental Carcinogens on "Receptor-Mediated Responses and Risk Assessment," Whistler, British Columbia, Canada, January 17-22, 1994.

Presentation to American Society of Preventive Oncology on "Gene/Environment Interactions," Bethesda, Maryland, March 7-9, 1994.

Presentation to Carcinogenesis Specialty Section of Society of Toxicology on "NTP Science and Policy Issues," Dallas, Texas, March 14-17, 1994.

Seminar to University of Cincinnati, Department of Environmental Health entitled, "Mechanism Based Toxicology and Risk Assessment," Cincinnati, Ohio, May 11, 1994.

Panel Member, Chlorine/Dioxin Plenary Session, Public Relations Society of America 1994 National Environmental Conference, Washington, D.C., June 20, 1994.

Co-Chair of Workshop on Risks and Benefits of Hormone Replacement Therapy and Oral Contraceptive Use, Stockholm, Sweden, July 1994.

Presentation to NIEHS Advisory Council on "Mechanism Based Toxicology and Risk Assessment," Research Triangle Park, NC, September 1994.

Presentation to North Carolina Supercomputing Center Symposium on Environmental Impact Prediction, "Comparison of National, State and Local Decision-Making and the Role of Simulation Technology," Research Triangle Park, NC, October 6, 1994.

Presentation to IARC Workshop on Receptor-Mediated Carcinogenesis: Receptor-Mediated Events and EPA's Reevaluation of Dioxin's Risks, Lyon France, October 14-16, 1994.

Presentation to American Public Health Association Symposium on Environmental Exposures Affecting the Health of Children: Problems and Solutions, Washington, D.C., November 1, 1994.

Presentation to North Carolina Society of Toxicology Entitled, "Recent Scientific Advances and Dioxin Risk Assessment," Chapel Hill, NC, November 1994.

Chair, Organizing Committee for NTP Workshop on Mechanism-Based Toxicology in Cancer Risk Assessment: Implications for Research, Regulation and Legislation. Presentation Entitled, "NTP in The Third Millennium." Chapel Hill, NC, January 11-13, 1995.

<u>Invited Seminars, Presentations, Symposia</u>: (continued)

Presentation to Toxicology Forum Entitled, "Mechanism-Based Toxicology and Risk Assessment," Washington, D.C., February 1995.

Organizer and Chair of Society of Toxicology Workshop on NTP Studies: Principles of Dose Selection and Applications to Mechanistic-Based Risk Assessment, Baltimore, MD, March 1995.

Presentation to Society of Toxicology Symposium on Cell Cycle Controls and Carcinogenesis. Baltimore, MD, March 1995.

Presentation to Society of Toxicology Symposium Entitled, "Debate on Risk Assessment for Receptor-Mediated Carcinogens," Baltimore, MD, March 1995.

Plenary Presentation to Symposium on Managing Occupational and Environmental Health Hazards, Helsinki, Finland, March 1995.

Chair, Organizing Committee for Workshop on Review of the Criteria and Listing in the Biennial Report on Carcinogens, Washington, D.C., April 1995.

Chair, Working Group on Research Needs for Dose Response Relationships. EPA Workshop on Endocrine Disrupters, Research Triangle Park, NC, April 1995.

Chair and Presenter in Session on "Biomarkers of Exposure," International Congress of Toxicology, Seattle, WA, July 1995.

Panelist on American Chemical Society Panel on "Changing Regulations, Chicago, IL, August 1995

Chair, Session on Hormonally-Active Chemicals at Gordon Research Conference on Hormonal Carcinogenesis, New Hampshire, August 1995.

Briefing to White House Staff on "Endocrine Disrupters, What We Know and What We Don't Know," Washington, D.C., September 1995.

Presentation to Dupont Chemical Company Entitled, "Mechanism-based Toxicology," Wilmington, DE, September 1995.

Presentation to Conference on Receptor-Mediated Toxicants and Their Risk Assessment, Entitled, "Confounding Factors for Endocrine Disrupters," Washington, D.C., October 1995.

<u>Invited Seminars, Presentations, Symposia</u>: (continued)

Presentation to Conference on Prevention of Environmentally-Related Cancer, Entitled, "Problems in Estimating Cancer Risks," Alburqueque, NM, October 1995.

Presentation to NIEHS Grantees in Worker Training, Entitled, "The NTP and Occupational Health," Research Triangle Park, NC, October 1995.

Presentation to Collegium Ramazzini Symposium on Living in a Chemical World, Entitled, "Molecular Toxicology and Risk Assessment," Washington, D.C., November 1995.

Plenary Presentation to NTP Workshop on Validation and Regulatory Acceptance of Alternative Toxicological Test Methods, Entitled, "The Role of the NTP in Test Method Development and Validation," Arlington, VA, December 1995.

Presentation to Meeting on Validation of Transgenic Animals in Toxicity Testing, Entitled, "Transgenic Animals and the NTP," Research Triangle Park, NC, February 1996.

Panelist on Implementation of EPA Revised Cancer Assessment Guidelines: Incorporation of Mechanistic and Pharmacokinetic Data, Society of Toxicology, Anaheim, CA, March 1996.

Chair, Session on Risk Assessment of Methylene Chloride, Society of Toxicology, Anaheim, CA, March 1996.

Presentation to Health Effects Institute Annual Meeting, Entitled, "Mechanism-based Toxicology and Risk Assessment: Use of Biomarkers," Ashville, NC, April 1996.

Plenary Presentation to Conference on Modulation of Chemical Toxicity and Risk Assessment, Entitled, "Dietary Factors and Risk Assessment Complexity", Tucson, AZ, June 1996.

Presentation to NTP Workshop on Developing Partnerships for the Validation of New Approaches for Toxicological Evaluations, Entitled, "New Initiatives for the NTP," Research Triangle Park, NC, July 1996.

Panelist on Society of Environmental Journalists Panel on Endocrine Disruptors, St. Louis, October 1996.

Presentation to Conference on Chemistry, Man and Environment, Entitled, "Use of Toxicology, Epidemiology, Toxicokinetics and Mechanisms in Risk Assessment of TCDD," Milan, Italy, October 1996.

<u>Invited Seminars, Presentations, Symposia</u>: (continued)

Presentation to Symposium on Dioxins and Furans: Epidemiologic Assessment of Cancer Risks and Other Human Health Effects, Entitled, "Molecular Epidemiology and Dosimetry of Dioxin and Related Chemicals," Heidelberg, Germany, November 1996.

Presentation to NIEHS Grantee Meeting On Endocrine Disruptors, Entitled, "Linking Fundamental Knowledge, Epidemiology, Toxicology and Risk Assessment: Good Science for Good Decisions," Research Triangle Park, NC, November 1996.

Presentation to BELLE Symposium on Toxicological Defense Mechanisms and the Shape of Dose Response Relationships, Entitled, "How Regulatory/Public Health Agencies Consider the Biological Effects of Low Level Exposures," Research Triangle Park, NC, November 1996.

Presentation to American College of Physicians, "Strengthening Science Base for Regulatory Decisions," NJ, January 1997.

Presentation to Society of Toxicology Workshop on the Use of Mode of Action Information in Cancer Risk Assessment, "Receptor Mediated Responses and Dioxin Cancer Risk," Cincinnati, OH, March 1997.

Presentation to EMF Science Review Symposium, "Risk Assessment: Salient Points and Steps for Consideration," Research Triangle Park, NC, March 1997.

Presentation to Environmental Management Commission, State of North Carolina, "Role of the Scientific Advisory Board in Risk Management," Raleigh, NC, April 1997.

Presentation to Workshop on Mechanistically-based Alternative Models for Toxicity Testing, "NTP Initiatives in Alternative Models," Research Triangle Park, NC, July 1997.

Chair of Organizing Committee for NIEHS Conference on Estrogens in the Environment.: Linking Fundamental Knowledge, Risk Assessment and Public Policy. Presentation Entitled, "Risk Assessment Issues: What We Know and Don't Know," Arlington, VA, July 1997.

Chair of Gordon Research Conference on Hormonal Carcinogenesis, Tilton, NH, July 1997.

Moderator, Session on Research Needs, Workshop on Marine Toxins, Research Triangle Park, NC, August 1997.

<u>Invited Seminars, Presentations, Symposia: (continued)</u>

Moderator, Workshop on Research Needs in Chemical Carcinogenesis, Conference on the Chemical Industries' Long-Range Research Initiatives, Research Triangle Park, NC, November 1997.

Chair of Organizing Committee for Workshop on Strategies for Assessing the Implications of Malformed Frogs for Environmental Health, Research Triangle Park, NC, December 1997.

Moderator, EPA Low Dose Workshop on Screening and Testing for Endocrine Disruptors, Washington, D.C., February 1998

Discussant, Conference on Superfund Communities: Who's Exposed and Who's at Risk, Session on Mechanistic Paradigms, Boston, MA, March 1998.

Internet Presentation, Talk City - Breakthroughs in Medicine, on Environmental Agents and Human Health, March 1998.

Presentation to Conference on Unique Freshwater Models for Environmental Health Research, "Uses of Aquatic Models by NIEHS and the NTP," Research Triangle Park, NC, April 1998.

Presentation to Science and Math Students at Northwood High School on "Rule of Science in Public Health Policy," Pittsboro, NC, April 1998.

Presentation to EPA Symposium on Extrapolation in Human Health and Ecological Risk Assessment, "Future Approaches for Improving Extrapolations to Health: Integration of Diverse Data Sets," Research Triangle Park, NC, April 1998.

Presentation to Workshop on Characterizing the Effects of Endocrine Disruptors on Human Health at Environmental Exposure Levels, "Quantitative Approaches to the Study of Homeostasis," Raleigh, NC, May 1998.

Presentation to Conference on Characterizing Human Risks, "The Changing Face of Toxicology: Mechanisms, Human Studies and Risk Assessment," Washington, D.C., May 1998.

Presentation to EPA Public Meeting on Drinking Water Disinfectant Byproducts, "Evaluation of New Science for Use in Chloroform Risk Assessments, Washington, D.C., May 1998.

Introductory Presentation to Peer-Review Panel on the Validation of the Local Lymph Node Assay for Use in Toxicology Testing, Gaithersburg, MD, September 1998.

Invited Seminars, Presentations, Symposia: (continued)

Introductory Presentation and Charge to Workshop to Evaluate Research Needs on the Use and Safety of Medicinal Herbs, Raleigh, NC, September 1998.

Introductory Presentation to Public Meeting on NIEHS Working Group Report on "Assessment of Health Effects from Exposure to Power-Line Frequency, Electric and Magnetic Fields, Washington, D.C., September 1998.

Presentation to Mississippi State University, "Critical Issues in Linking Science to Public Health Policy," November 1998.

Presentation to Symposium Honoring David Rall entitled, "Can Rodent Cancer Tests Predict for Human Cancers: The Role of Mechanistic Studies in Cancer Testing," Little Rock, AR, November 1998.

Chair of Organizing Committee for OSTP (White House) Workshop on Scientific Issues Relevant to Assessment of Health Effects from Exposure to Methylmercury, Raleigh, NC, November 1998.

Introductory Presentation to Peer Review Panel on Validation of Corrositex Assay for Use in Toxicology Testing, Bethesda, MD, January 1999.

Presentation at Society of Toxicology Meeting (Epidemiology Section) on the "Integration of Diverse Data Sets in Toxicological Evaluations," New Orleans, LA, March 1999.

Presentation at Conference on Fumonisn Toxicity, "Developing Partnerships between FDA and NIEHS: Linking Science to Public Health Policy, Washington D.C., June 1999.

Presentation to NCI/NIEHS Joint Meeting on Environmental Health, "Opportunities for Collaborative Research," Research Triangle Park, NC, June 1999.

Presentation to Workshop on Thimerosal Containing Vaccines, "Pharmacokinetics and Toxicity of Ethyl and Methylmercury," Bethesda, MD, August 1999.

Moderator of EPA/NIEHS Workshop Roundtable on Applying Biomarker Research to Risk Assessment and Public Health, Chapel Hill, NC, August 1999.

Moderator (Research Recommendations Session) and Member of Steering Committee of Chemical Manufacturing Association Workshop to Evaluate Research Priorities for Endocrine Active Compound Risk Assessment Methods, Research Triangle Park, NC, August 1999.

Invited Seminars, Presentations, Symposia: (continued)

Presentation to Expert Panel Meeting on Reproductive Toxicity of Phthalate Esters (NTP Center for the Evaluation of Reproductive Risks), Washington, D.C., August 1999.

Chair, Session on Toxicokinetics at Dioxin 99 Meeting, Venice, Italy, September 1999.

Presentations, to NIEHS Council on "NTP Research Priorities and External Reviews" and "Medicinal Herb Research," Research Triangle Park, NC, September 1999.

Presentation to Stakeholder Public Meeting on the NTP's Report on Carcinogens, Washington, D.C., September 1999.

Co-Chair Organizing Committee and Moderator of Breakout Group Presentations for Workshop on "The Role of Human Exposure Assessment in the Prevention of Environmental Disease," Rockville, MD, September, 1999.

Member Organizing Committee, Workshop on the Harmonization of Cancer and Non-Cancer Risk Assessments, Washington, D.C., October, 1999.

Selected Advisory Boards and Related Activities:

Toxicology Forum; expert on developmental pharmacology for the purpose of protocol development for in vitro toxicity testing, 1978.

Environmental Protection Agency; implementation of Toxic Substances Act as it applies to children. 1981 - 1984.

Education program for nurses to increase their skills in environmental health, Health Resources Administration, 1981.

Member, Peer Review Panel, Food Chain Transport of Synfuels, Comparative Animal Research Laboratory, Oak Ridge, Tennessee.

Temporary Advisor to International Agency for Research on Cancer, "Mechanisms by which Hormones Influence Carcinogenesis," Lyon, France, April, 1983.

Consultant - Centers for Disease Control, Health Implications of TCDD Contamination of Residential Soil, June, 1983.

Consultant - U.S. Environmental Protection Agency, Risk Analysis of Synfuels, Corvallis, Oregon, October, 1983.

Selected Advisory Boards and Related Activities: (continued)

Peer Review Panel, National Center for Toxicological Research, Food and Drug Administration, Washington, D.C., November, 1984.

Organizing Committee, Section on Environmental Toxicology and Pharmacology, American Society for Pharmacology and Experimental Therapeutics, 1984 - 1987.

Chairman of Panel on "Application of Biochemical Markers in Risk Assessment", Committee to Coordinate Environmental Health and Related Programs, Department of Health and Human Services, 1986 - 1988.

National Institute of Environmental Health Sciences' Representative for NCI, NIOSH, EPA, NIEHS Extramural Program in Biochemical Epidemiology, 1986 - Date.

Member of Subcommittees of Research Needs and Risk Assessment, Committee to Coordinate Environmental Health and Related Programs, Department of Health and Human Services, 1986 - 1993.

EPA Scientific Advisory Board, Subcommittee on Halogenated Organics, September, 1986.

Office of Science and Technology Policy Panel on Risk Assessment, 1986.

International Program on Chemical Safety, Commission of the European Communities, WHO Committee to Prepare Consensus Report on "Biological Methods for Monitoring Exposure to Mutagenic or Carcinogenic Agents", July, 1987.

Member of the National Center for Toxicological Research Sponsored Panel on Reproductive Risk Assessment for Dioxin, Little Rock, Arkansas, September, 1987.

Scientific Advisory Board, PMI Strang Clinic, New York, 1987 - 1990.

Member of DHHS panel on "Evaluation of Risk Assessments of Dioxin", August, 1989.

Contributor to WHO/IPCS Monograph on Principles for the Assessment of Risk from Exposure to Chemicals. Prepared Background paper on Biological Markers of Exposure and Effect, 1989 - 1990.

Chairman, Dioxin Review Panel for Chemical Industry Institute of Toxicology, 1990 - 1992.

Member, Department of Health and Human Services Committee on Revision of Policies on Risk Assessment and Risk Management, 1990.

Selected Advisory Boards and Related Activities: (continued)

Member, Scientific Advisory Panel, Chemical Industry Institute of Toxicology, 1990.

Member, Subcommittee on Risk Assessment, DHHS Committee to Coordinate Environmental Health and Related Programs, 1990-1993.

Member, Working Party on Research Needs of the Committee on Life Sciences and Health Subcommittee on Risk Assessment, 1991.

Preparation of background paper on "Animal Cancer" for EPA's Reevaluation of Dioxin's Risks, 1991.

Co-chair Committee on "Dose-Response Model for Dioxin's Effects," for EPA's Reevaluation of Dioxin's Risks, 1992 - Date.

Health Effects Institute Panel on Research Needs for Mobile Air Emissions; chaired benzene working group, 1992 - 1993.

Chairman, Scientific Advisory Board for North Carolina Air Toxics Regulations, 1992 - Date.

Scientific Advisory Board, Chemical Industries Institute for Toxicology, 1993.

Organizing Committee, International Symposium on "Butadiene Health Effects," Helsinki, Finland, May 1993

IARC Workshop on Quantitative Estimation and Prediction of Cancer Risks to Humans, Lyon, France, October 18-22, 1993.

Vice Chair for Science, National Science and Technology Policy Subcommittee on Risk Assessment, 1994 - 1997.

Federal Liaison to EPA Science Advisory Board, Environmental Health Committee, 1994 - Date.

Co-Chair, Interagency Committee to Assess Health Effects of Oxygenated Fuels, 1995 - 1996.

Chair, National Occupational Research Agenda: Experimental Priorities, Washington, D.C., December 1995.

Selected Advisory Boards and Related Activities: (continued)

Congressional Testimony to House Science Committee, "Scientific Integrity, and Federal Policies and Mandates, December 1995.

Chair, Search Committee to Select Director for NIOSH Health Effects Laboratory Division, 1996.

Chair, IARC Monograph Meeting on Carcinogenicity of Tamoxifen and Other Pharmaceuticals, February 1996.

Presentation to National Research Council Committee on Research Opportunities and Priorities for EPA, May 1996.

Chair, National Science and Technology Interagency Review of EPA's Revised Guidelines for Reproductive and Developmental Toxicology, August 1996.

Steering Committee for Scientific Review of EPA's Methylene Chloride Risk Assessment - Co-Sponsored by EPA, NTP, ATSDR and the Halogenated Solvents Industrial Alliance, 1996 - Date.

Vice Chair for National Science and Technology Council Committee on Human Health Effects of Endocrine Disruptors, 1996 - Date.

Member, North Carolina Legislative Committee for Review of Air Toxics Programs in North Carolina, 1996 - 1997.

Member, Endocrine Disruptors Screening and Testing Advisory Committee (EDSTAC) for Addressing EPA's Congressional Mandates on Endocrine Disruptor Screens, 1996 - Date.

Member, Committee for Implementing NIOSH's National Occupational Research Agenda, 1996 - 1997.

Risk Characterization Writing Team for EPA's Reevaluation of Dioxin's Risk, 1996 - Date.

Chair, IARC Monograph Meeting on Carcinogenicity of Dioxin and Related Chemicals, February 1997.

Member, Technical Panel for World Trade Organization Adjudication of International Trade Dispute on Export of Animals Fed Growth Promoting Substances, February 1997.

Chair, Cancer White Paper Group, State of the Science Steering Committee, Chemical Manufacturing Association, 1997 - 1998.

Selected Advisory Boards and Related Activities: (continued)

Member, Endocrine Disruptor Steering Committee, Chemical Manufacturing Association, 1997 - Date.

Member, North Carolina Task Force on Human Health Effects of Pfiesteria Toxins, 1997 - 1998.

Member, Peer Review Panel for Review of Environmental Toxicology Program, NHEERL, EPA, 1997.

Member, Scientific Advisory Committee, Chemical Industries Institute for Toxicology, 1997 - 1998.

Chair, OSTP Coordinated Interagency Review of EPA's Report to Congress on Health Effects of Mercury, 1997 - Date.

Member, ILSI Risk Science Institute Steering Committee, Framework for Cumulative Risk Assessment, 1998 - 1999.

Member, WHO Steering Committee on Endocrine Disruptors, 1998 - Date.

Presentation on Research Priorities in Environmental Health to National Research Defense Council, June 1998.

Co-Chair, NC Department of Health Panel to Investigate Possible Health Effects of Intensive Livestock Farming, 1998 - Date.

Presentation to EPA Science Advisory Board for Integrated Exposure Assessment, "Exposure Assessment Issues for NIEHS and the NTP," March 1999.

Presentation to National Academy of Science Panel on Interagency Evaluations of Human Health Effects from Methylmercury Exposure, Washington, D.C., June 1999

Interagency Committee on Evaluation of European Union Risk Assessments on Health Effects of Consuming Meats from Growth-Promoted Animals, May 1999 – Date.

Science Advisory Board for Chemical Industries Institute for Toxicology, August 1999.

Co-Chair Committee on Environment and Natural Resources (White House Science Office) Review of NAS Report on Endocrine Disruptors, September 1999.

BIBLIOGRAPHY

- 1. Lucier, G. W. and Menzer, R. E.: Metabolism of dimethoate in plants in relation to its mode of application. J. Agric. Food Chem. <u>16</u>: 936-945, 1968.
- 2. Lucier, G. W. and Menzer, R. E.: Nature of the oxidative metabolites of dimethoate formed in bean plants, rats and liver microsomes. J. Agric. Food Chem. <u>18</u>: 698-704, 1970.
- 3. Brubaker, P. E., Lucier, G. W. and Klein, R.: The effects of methylmercury on protein synthesis in rat liver. Biochem. Biophys. Res. Commun. 44: 1552-1558, 1971.
- 4. Lucier, G. W., McDaniel, O. S. and Matthews, H. B.: Microsomal rat liver UDP-glucuronyltransferase: Effects of piperonyl butoxide and other factors on enzyme activity. Arch. Biochem. Biophys. <u>145</u>: 520-530, 1971.
- 5. Lucier, G. W. and Menzer, R. E.: Nature of the neutral phosphorus ester metabolites of phosphamidon formed in rats and liver microsomes. J. Agric. Food. Chem. <u>19</u>: 1249-1255, 1971.
- 6. Matthews, H. B., McKinney, J. D. and Lucier, G. W.: Dieldrin metabolism excretion and storage in male and female rats. J. Agric. Food Chem. <u>19</u>: 1244-1248, 1971.
- 7. Klein, R., Herman, S., Brubaker, P., Lucier, G. and Krigman, M. R.: A model of acute methylmercury intoxication in rats. Arch. Pathol. <u>93</u>: 408-418, 1972.
- 8. Lucier, G. W., Klein, R., Matthews, H. B. and McDaniel, O. S.: Increased degradation of rat liver CO-binding particles by methylmercury hydroxide. Life Sci. (Part II) 11: 597-605, 1972.
- 9. Lucier, G. W. and McDaniel, O. S.: Alterations in rat liver microsomal and lysosomal b-glucuronidase by compounds which induce hepatic drug metabolizing enzymes. Biochim. Biophys. Acta 261: 168-176, 1972.
- 10. Lucier, G. W., McDaniel, O. S., Klein, R. and Brubaker, P. E.: Effects of methylmercury hydroxide on rat liver microsomal enzymes. Chem. Biol. Interact. <u>4</u>: 265-280, 1972.
- 11. Lucier, G. W., McDaniel, O. S., Williams, C. and Klein, R.: Effects of chlordane and methylmercury on the metabolism of carbaryl and carbofuran in rats. Pestic. Biochem. Physiol. 2: 244-255, 1972.
- 12. Brubaker, P., Klein, R., Herman, S., Lucier, G., Alexander, L. and Long, M.: Methylmercury and protein synthesis: Cytogenetic disturbances in target organs of asymptomatic methylmercury-treated rats. J. Mol. Pathol. <u>18</u>(3): 263-280, 1973.

13. Lucier, G. W., Matthews, H. B., Brubaker, P. E., Klein, R. and McDaniel, O. S.: Effects of methylmercury on microsomal mixed-function oxidase components of rodents. Mol. Pharmacol. 9: 237-246, 1973.

- 14. Lucier, G. W., McDaniel, O. S., Bend, J. R. and Faeder, E.: Effects of hycanthone and two of its chlorinated analogs on hepatic microsomes. J. Pharmacol. Exp. Ther. <u>186</u>: 416-424, 1973.
- 15. Fowler, B. A., Brown, H. W., Lucier, G. W. and Beard, M. E.: Mercury uptake by renal lysosomes of rats ingesting methylmercury hydroxide: Ultrastructural observation and energy dispersive x-ray analysis. Arch. Pathol. 98: 297-301, 1974.
- 16. Fowler, B. A., Brown, H. W., Lucier, G. W. and Krigman, M. R.: The effects of chronic oral methylmercury exposure on the lysosome system of rat kidney. Morphometric and biochemical studies. Lab. Invest. <u>32</u>: 313-322, 1975.
- 17. Fowler, B. A., Lucier, G. W. and Mushak, P.: Phenobarbital protection against methylmercury nephrotoxicity. Proc. Soc. Exp. Biol. Med. <u>149</u>: 75-79, 1975.
- 18. Hook, G. E. R., Haseman, J. K. and Lucier, G. W.: Induction and suppression of hepatic and extrahepatic microsomal foreign compound metabolizing enzyme systems by 2,3,7,8-tetrachlorodibenzo-p-dioxin. Chem. Biol. Interact. 10: 199-214, 1975.
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BOOK CHAPTERS, CONFERENCE PROCEEDINGS, MONOGRAPHS

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Micro-Chemical Explosive Residue and Blast Damage Analysis Concerning the Events at the Branch Davidian Complex in Waco Texas

Prepared for the Office of Special Counsel

Dr. Gerry Murray
Forensic Science Agency of Northern Ireland

Mr. David A. Green Lake County Regional Forensic Laboratory (OH)

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1.0 Introduction

1.1 Background

In December 1999, we were contacted by the Office of Special Counsel, and informed of the inquiry into allegations concerning the siege at the Branch Davidian complex in Waco, Texas in April 1993. These allegations included (a) that an explosive device, incorporating a shaped charge, had been initiated on the roof of the concrete "bunker" within the complex and (b) that explosives had been used to remove the neck of a large propane tank to reinforce the explosion and fire. The Forensic Science Agency agreed to review the explosives aspects of the inquiry and, if necessary, examine physical evidence for the presence of explosives residues. The Lake County Regional Forensic Laboratory, Ohio, agreed to perform all necessary on-site examinations of physical evidence.

1.2 Issues

(1) Did government agents use an explosive device to breach the concrete bunker at the Branch Davidian complex on April 19, 1993: (2) Did government agents use an explosive device to detonate the ruptured propane tank found amongst the debris of the Branch Davidian complex.

1.3 Documentary and Physical Evidence

- (1) The Office of Special Counsel provided us with substantial documentation and photographs in relation to this matter. We received the material over the course of several months. The material included approximately three hundred fifty seven (357) photographs and six (6) videos, which show the complete compound before, during, and after the fire, the concrete bunker area after the fire, processing of the scene by law enforcement personnel, and the demolition of the concrete bunker. We were supplied with maps, floor plans and diagrams of the Branch Davidian complex. We were also supplied with numerous statements from witnesses, which include but are not limited to, law enforcement personnel, Branch Davidians, and experts from various scientific and medical disciplines.
- (2) With the assistance of the Office of Special Counsel, The United States District Court for the Western District of Texas released into Dr. Murray's custody lengths of reinforcing bar which were wrapped in tarpaulin together with control materials. The Office of Special Counsel informed us, that the reinforcing bar had been part of the roof structure of the concrete bunker.

Mr. Green was also granted permission to travel to the Court's secured storage area to examine evidentiary items collected from the roof and inside the concrete bunker. Mr. Green and investigators from the Office of Special Counsel traveled to Waco, Texas, and examined the evidence collected from the Branch Davidian compound. Mr. Green used cotton tipped applicators soaked in methyl alcohol to "swab" four (4)

gas masks that were originally located inside the concrete bunker. Mr. Green also "swabed" an empty propane tank which exhibited a large hole in one end. Mr. Green swabbed the area around the edge of the damaged portion of the propane tank. The collected swabs were mailed by Federal Express to Dr. Murray by Mr. Green on July 10, 2000.

Mr. Green also reviewed several suspected grenade parts and fragments, the remains of a number of gas masks, the remains of a number of assorted rounds of ammunition, together with a bible, and pieces of paper. These items all were labeled as having originated on the roof of the concrete bunker. These items were retrieved from the secured storage location at a later date and sent to Dr. Murray for laboratory examination by the Office of Special Counsel.

1.4 Conclusion

Based on our review of the documents, photos, physical evidence, and our microchemical analysis of residue taken from the concrete bunker reinforcement bars, the questioned propane tank, and debris inside and on top of the concrete bunker, we conclude that: (1) Government agents did not use a shaped charge or other high explosive type device to breach the concrete bunker at the Mount Carmel complex on April 19, 1993; and (2) Government agents did not use an explosive device to detonate the exploded propane tank found amongst the debris of the Mount Carmel complex.

2.0 Explosions and Explosives

Before dealing in detail with the specific issues submitted to the Forensic Science Agency and the Lake County Regional Forensic Lab by the Office of Special Counsel, it is important to consider briefly some of the concepts and terms used in explosives investigations.

An explosion may be defined as a sudden, rapid release of previously confined energy. This release is accompanied by those physical characteristics normally associated with an explosion namely loud noise, bright flash of light, heat and the physical movement of objects close to the seat of the explosion. There are essentially three categories of explosion, (1) mechanical explosion, (2) chemical explosion and (3) nuclear explosion. For the purpose of this report, only (1) and (2) will be considered.

A mechanical explosion occurs when a system under pressure finally disrupts. The simplest example of this is a child's rubber balloon popping or a liquefied petroleum gas cylinder rupturing as a result of being subjected to a sustained, intense fire.

A chemical explosion results from a chemical reaction, but a reaction producing a high level of energy very fast. There are two types of chemical explosion, namely, dispersed explosions and condensed explosions. In a dispersed explosion, the reactants, usually in the form of a combustible gas and air, in suitable proportions, are dispersed within a

given volume. Introduction of an ignition will start the combustion process and the reaction will proceed rapidly, outwards from the point of ignition until the pressure build-up disrupts the structure confining the reactant mixture. This would be the scenario, for example, in a domestic gas explosion. The effects of such an explosion are maximized at points remote from the point of ignition. In a condensed explosion, the reactants (explosives) are in a "condensed", frequently solid, form. Here, initiation of the explosive produces an energy release at a point source (seat of explosion) and the effects of the explosion diminish rapidly with distance from the seat of the explosion.

Within condensed explosives, there are "low order" and "high order" explosives. Low order explosives deflagrate (burn) and rely on confinement for effect. A typical example would be a pipe bomb type device or improvised hand grenade, initiated via a short length of igniferous fuse. High order explosives detonate a process whereby a shock wave travels through the explosive. High order explosives are characterised by very high energy release.

One of the allegations in the Office of Special Counsel investigation concerns the use of a "shaped charge" device. When a high order explosive charge is initiated, the effects of the explosion are experienced in all directions. This is not the case with a shaped charge. The shaped charge concept configures the explosive, usually by means of a metal cone, such that the explosive effects are "focused" towards a specific point. A simple, non-explosive, example is the focusing of the sun's rays using a magnifying glass. The shaped charge effect is designed primarily to defeat substantial, particularly armoured, targets. The use of a shaped explosive charge placed directly on a target surface will produce a hole with a diameter approximating the diameter of the face of the charge.

3.0 History of the Concrete Bunker

The concrete bunker in the Branch Davidian Complex resided at the base of the four story central tower. It served as the first floor base of the tower with three floors built above it. The concrete bunker was constructed of reinforced concrete and exhibits one door, which served as both the entrance and exit. According to the statements of Branch Davidian Katherine Schroeder there was no door in the doorway. The concrete bunker was approximately 7.1 meters by 7.3 meters in area. The walls and roof are approximately 7 inches thick and exhibited two concrete support beams. According to Branch Davidians and Davidian historians the concrete bunker was built in the 1930's. In 1980, the concrete bunker was involved in a fire which fellow Davidians claim may have been started by David Koresh, then known as Vernon Howell. The Branch Davidians used the concrete bunker as a weapons and ammunitions storage according to Davidians Graeme Craddock and Katherine Schroeder, this fact is also confirmed by photographs taken after the fire.

4.0 Fire and Structural Damage to the Concrete Bunker

Pictorial images, whether in video or still photography format, can prove to be a very valuable tool in assessing the development of an incident, such as that at Waco, particularly when used in combination with an on-site scene examination. The video tapes and photographs, provided to us by the Office of the Special Counsel, show a sequence of events before, during and after the intense fire at the Branch Davidian complex. At approximately 12:18 P.M. on April 19, 1993, the central tower over the concrete bunker collapsed. Shortly thereafter a bright flash is seen above the position of the concrete bunker, followed by a large fireball. The fireball is consistent with the ignition of a large quantity of flammable vapour.

There are various photographs of the concrete bunker roof, both from the outside and from within. One photograph depicts a roughly circular hole, with bent or bowed lengths of reinforcing bar clearly visible. Although the bars are deformed, there is no apparent evidence of high order explosion damage. Close to this hole is what appears to be the barrel of an M16 rifle, see Appendix 2, Figure 1. Using the distance from the front of the barrel to the front of the sight as a reference, we estimated the diameter for the hole to be approximately 47 centimeters. As observable in several of the photographs, it was necessary for law enforcement officials to reinforce the roof before removing the bodies and collecting evidence from inside the concrete bunker do the unsafe conditions of the roof. See Appendix 2, Figure 2, which depicts the reinforcing knuckles on the sagging reinforcement bars. This is not the only hole in the roof. Heat damage and sag have also opened up holes along the perimeter of the bunker roof, see Appendix 2, Figures 3, 4, 5 and 6.

We understand that Office of Special Counsel fire expert, Dr. Wickstrom, has determined that spalling significantly damaged the roof of the bunker. Photographs of the inside of the concrete bunker show areas of this spalling on the ceiling, one around the hole through the roof and another nearby, although there has been no penetration of the roof in the latter case, see Appendix 2, Figure 7.

The interior photographs also show a significant number of firearms in the concrete bunker, see Appendix 2, Figures 8. The photo in Appendix 2, Figure 9, shows the hole in the concrete bunker roof and, nearby, at approximately the 4 o'clock position, what appears to be a circular depression.

The FBI Laboratory report of 6 December 1993, addressed to Sargent Miller of the Texas Rangers, advises that "Damage to the outside top of the concrete roof of the bunker in Search Zone M is consistent with at least two seats of explosions". The roof of the concrete bunker was designated by law enforcement as search zone M.

The walls of the bunker exhibit numerous cracks to various joints and throughout all four walls. These cracks are documented in several photographs, see Appendix 2, Figures 10, 11, and 12. The bunker was levelled by law enforcement officials because of safety

reasons, and this too is exhibited in several photographs, see for example Appendix 2, Figure 15.

5.0 The Concrete Bunker

5.1 Condition of Bunker

The concrete bunker was constructed of what is reported to be 70 year old concrete, and has been exposed to at least 2 documented fires. The heat of the fires has caused the concrete to spall, as confirmed by Dr. Ulf Wickstrom, weakening the structure and leading to substantial cracking of the walls.

Branch Davidians have also informed the Office of Special Counsel there was no door over the opening to the concrete bunker. Under these conditions if a device was placed on the roof and detonated, some pressure damage would have occurred, but damage would also have occurred from vibrations on the surface area. However, after a careful review of the physical condition of the bunker we do not see the type of damage typically associated with a high explosive charge. More damage would be expected to the concrete bunker, if a device were detonated on a structure of this type and in this condition.

While it is our opinion that the 47 centimeter hole located in the roof of the concrete bunker does exhibit some characteristics consistent with a shaped charge, namely, the round shape of the hole, this is not determinative that a shaped charge created the opening. The condition of the concrete bunker must be taken into consideration. Dr. Ulf Wickstrom, a fire expert of the Office of Special Counsel, has stated that spalling (see section 5.2 of this report) caused the hole. Ronald E. Koester, an engineer for the Texas Department of Transportation Waco, Texas district, also stated that he believed the hole may have been caused by some type of heavy object, due to the spalling. Therefore, while it may be true that a shaped charge may cause a hole, with characteristics similar to the hole in question, the shape of the hole is not determinative of the cause of the hole.

The Office of the Special Counsel supplied us with calculations regarding the deepest incursion of the CEV's used at Branch Davidian Complex on April 19, 1993. We requested information to determine whether the CEV's could have contributed to the damage to the bunker or whether the CEV's could have been used as a tool to deliver a shaped charge to the top of the bunker. In data supplied to the OSC by VDS(UK), it was noted that at approximately 1149 hours a CEV moves forward into the Branch Davidian complex and incurs approximately 15 feet. This is the deepest penetration into the complex proximate to the concrete bunker. Based on the calculations supplied to us by the OSC the boom of the CEV would be approximately 17 feet short of the bunker roof. Consequently the CEV and its boom could not have been used to push debris over the bunker doors or been used to place a shaped charge on the bunker roof. It simply did not get close enough for that purpose. Moreover, even if the CEV had incurred far enough for the boom to reach the bunker roof, the boom is not manoeuvrable enough to

administer a shaped charge in the center of the bunker roof. It is simply a tactical and technical impossibility.

The Office of the Special Counsel has also supplied us with the Declaration of Benton K. Partin, B/G USAF (Ret.), in which Gen. Partin's states that, "the blast pressure inside the vault was sufficiently great to do major structural damage to the reinforced concrete vault shell". While this indeed is a possibility, it is not the only explanation for the structural damage. As discussed above age, materials, and prior fire exposure all contributed to the condition of the bunker. We disagree with Gen. Partin, as the damage to the bunker is inconsistent with the use of a shaped charge. It is our opinion that a concrete structure of that age and condition would have suffered more substantial damage if subjected to such a charge.

Gen. Partin also declares, "the vault's concrete roof damaged apparently from an explosive breaching charge that had been placed on the floor of the second floor, i.e., on top of the vault. The hole is typical of the damage you get with a breaching charge on a reinforced concrete." As stated above, we agree that the shape of the central hole is consistent with a shaped charge, any conclusion based on shape alone is unsubstantiated and unreliable.

Gen. Partin also declares, "a military tank penetrating the building in front of the vault. Its depth of penetration probably pushed debris from four walls, the kitchen and the passageway close to or against the only vault door". As stated above this did not occur in the complex, see Appendix 2, Figure 12. We disagree with Gen. Partin, as his assumption is not supported by the VDS(UK) mensuration calculations.

Finally, Gen. Partin in his declaration states, "the explosion process reveals that the first show of bright, white light from the explosion comes from the fourth floor window the left near the juncture of the front and left faces of the fourth floor walls." Gen. Partin is simply incorrect. Upon review of video supplied by the Office of Special Counsel, it is noted that the tower burnt down approximately seven minutes before the fire ball explosion is viewed, see Appendix 2, Figure 14.

5.2 Heat and Damage to the Concrete Bunker

As previously stated in this Report, an expert in the field of fire damage, Dr. Ulf Wickstrom, concluded that based on his review of "TV footage" and photographs, that the hole in the center of the concrete bunker roof was caused by spalling, due to fire damage. We find no evidence to suggest otherwise. We have, however, found evidence of one or more low explosive charges having detonated, which may have contributed to the damage to the roof of the concrete bunker and hastened the spalling phenomenon. These low explosive charges are discussed in section 5.7 below.

5.3 Size, Placement, and Use of a Shaped Charge

If a shaped charge had been detonated on the roof of the concrete bunker, the face diameter of the charge would by necessity approximate the diameter of the hole, 2 to 3 feet. (47 centermeters). This would represent a sizeable device, with serious implications for clandestine deployment. The initiation of such a device would require some form of electrical firing mechanism with time delay (or remote control), power and detonation facilities, none of which were recovered from the Branch Davidian complex debris. It is also likely that a substantial shaped charge would have caused more damage to the reinforcing bars than that observed.

A shaped charge must be orientated in a specific direction in order to function properly. This characteristic of a shaped charge makes it difficult to set up and use properly. Placement of this type of device would be a difficult task to perform without being noticed. As previously mentioned in this report, the boom of the CEV's did not reach the area of the concrete bunker, therefore, it would highly unlikely that this could be a possible means to deliver and set the charge. Furthermore, it would not be practical to just throw a shaped charge device into an area in hopes that it would land, set-up, and function properly. Therefore, it is the opinion of the examiners that it would have been extremely difficult, if not impossible, from a tactical and technical point of view to correctly set a shaped charge under the conditions present at the Branch Davidian complex on April 19, 1993.

5.4 Autopsy Evidence

The Office of Special Counsel also supplied us with copies of the Tarrent County Medical Examiners Office autopsies of the Branch Davidians that perished on April 19, 1993. These reports do not indicate any blast or explosive damage to the bodies. Office of Special Counsel forensic Pathologist, Dr. Michael Graham, has also found that none of the victims, suffered lung blast injury or high velocity impact injuries consistent with a high explosive detonation.

This is a significant finding, since persons within the concrete bunker, particularly in the area below the hole, see Appendix 2, figure 10, would have been subjected to blast damage from the explosion. If a shaped charge had detonated, the large amount of pressure caused by the explosion would cause damage to the occupant's lungs and injuries from the high velocity impact from concrete. Based on the absence of these characteristics, injuries on individuals found inside and on top of the bunker, i.e. proximate to any alleged explosion, and other details explained in this report, it is the opinion of the examiners that a shaped charge could not have been detonated.

5.5 Laboratory Examination of the Reinforcing Bars

In May 2000, the Office of Special Council acquired and provided to the Forensic

Science Agency, five twisted lengths of steel reinforcing bar taken from the roof the concrete bunker. The bars were shipped in wraps of blue tarpaulin, green cloth and nylon cloth, see Appendix 2, Figure 19. These bars were examined for the presence of material of a high explosive nature. No such materials were detected.

The detection of explosive residues on a surface is dependant upon a number of factors including the type of explosive, the degree of contact/exposure, the time which has elapsed since contact/ exposure, and the treatment of the surface prior to examination. Exposure to an intense fire can also have a dramatic influence on the recovery of explosive residues.

Materials such as nitroglycerine are quite volatile and will evaporate relatively quickly. High performance explosives, such as RDX or PETN, like that used in shaped charges, however, are non-volatile and can remain for long periods of time. Because traces of nitroglycerine were detected on the metal reinforcement bars, it is highly unlikely that traces of a high performance explosive, which deteriorate much slower, would not have survived as well. This is extremely suggestive that a high explosive was not used to breach the concrete bunker.

5.6 Laboratory Examination of Metal Grenade Fragments and Other Debris

A number of items, designated 1046, 1059, 1068, 1282, 1469, 1610 and 1631 were received for examination from the Office of Special Counsel.

Items 1068, 1610 and 1631 consisted of assorted metal items including fragments of grenade body (U.S. MK2 format), some as "multiple" sections, the remains of the top section of a grenade igniter set, the remains of rounds of small arms ammunition, and parts of magazine clips.

Two features were of particular significance in relation to the grenade remains. The physical appearance of the grenade body fragments indicated that the grenades had exploded. However, the size of the fragments, particularly the "multiple" sections, indicated that the grenades had contained a low order explosive, not a high performance explosive normally associated with combat grenades or a primary high explosive such as mercury fulminate, see Appendix 2, Figures 16 and 18. A number of the grenade fragments were examined for the presence of residues consistent with the use of a low order explosive. No significant residues, of any kind, were detected.

The second feature of significance was the remains of the grenade igniter set, see Appendix 2, Figure 18. The top section of the grenade igniter set contains a percussion cap and a spring-loaded striker. Prior to use, the striker is held back by a fly-off lever which is secured by a split pin/ring assembly, the pin being inserted through aligning holes in the top of the igniter set; the ends of the pin are splayed to prevent accidental removal of the pin. The pin must be removed before the fly-off lever can be ejected and the striker can hit the percussion cap. In the case of the igniter set, the striker had been

released. If a grenade, with the split pin in place, exploded, particularly if the explosive was a low order explosive, there would not be sufficient force to remove the split pin. Therefore, it appears that the igniter set in item 1610 had been deliberately activated. It is noted that Special Agent Ronald Knight stated that at approximately 1230 hours he heard what he thought were grenades exploding inside the Branch Davidian complex.

On May 24, 2000, while in Waco, Texas, Mr. Green also obtained sample swabs from four gas masks, see Appendix 2, Figure 17, originally recovered inside the concrete bunker, using the sampling technique previously discussed. These samples were collected because they were found in the area directly below the hole in the roof of the concrete bunker. These items were selected on the chance that they would contain any potential post blast residue due to their position near the hole. Mr. Green forwarded the samples, on July 10, 2000, to the Forensic Science Agency for examination, by Dr. Murray. The swabs were examined for the presence of material of an explosive nature. Nitroglycerine was detected on one of the swabs taken from one of the masks. The significance of the detection of nitroglycerine is minimized by the fact that nitroglycerine is present in small weapons ammunition. Countless numbers of spent rounds of ammunition were present inside and on top of the concrete bunker. The examiners therefore expected the detection of nitroglycerine.

A number of items, designated, items 1046, 1059 and 1469 consisting of the remains of a number of gas masks and filters were received from the Office of Special Counsel. These items were examined for the presence of material of an explosive nature. No residues were detected.

5.7 Explosive Materials in the Compound

In the December 6, 1993, FBI Laboratory report, to Sgt Miller of the Texas Rangers, a reference is made to the identification of nitroglycerine. Whilst nitroglycerine has been used as an ingredient of some commercial blasting explosives, as noted above, it is widely encountered as a constituent of many small arms ammunition propellant. The presence of firearms and ammunition in and on the "bunker" indicates that the nitroglycerine originated from small arms ammunition and not an explosive charge.

In the statements of Donald Bunds, several other Davidians, and law enforcement intelligence reports, it is alleged that the inhabitants of the Branch Davidian complex had purchased numerous dummy grenades, and had converted those to live grenades. Donald Bunds also states that the materials necessary to produce mercury fulminate were not only purchased, but also used. Mercury fulminate is considered to be a high explosive material, which has been used as an initiator for high explosive devices.

5.8 Conclusion

It is the opinion of the examiners that a shaped charge explosive was not used to breach the concrete bunker at the branch Davidian complex on April 19, 1993. This conclusion is based on the following evidence:

- (1) The physical history of the bunker, specifically age, and its prior involvement in 2 fires.
- (2) The heat damage caused by spalling, which caused weakening of the structure, including the characteristic cracking joints, holes, etc.
- (3) The observed damage to the roof of the concrete bunker is consistent with a small, low order explosion, or a number of closely associated explosions having occurred in conjunction with the physical condition of the structure.
- (4) The absence of residues of a high performance explosive on the reinforcing bar, whilst not conclusive, indicate that such an explosive had not been used.
- (5) The lack of damage to the bunker and the fact that the bunker would have exhibited much more damage had it been subjected to a shaped charge.
- (6) The lack of blast damage to those in the bunker.
- (7) The recovery of grenade fragments from the roof of the concrete bunker.
- (8) Statements from Branch Davidians that they had generated mercury fulminate
- (9) The fact that it would be difficult, if not impossible, from a tactical perspective to set a shaped charge under the condition present on April 19, 1993.
- (10) A shaped charge will create a hole which mirrors it own size, thus requiring an unusually large and difficult to place shaped charge to create the hole in question.

6.0 Ruptured Propane Tank

6.1 Condition of Propane Tank

In this section we address the second of the allegations we were charged to investigate whether an explosive had been used to detonate the exploded propane tank found amongst the debris of the Branch Davidian complex.

In June 2000, while in Waco, Texas, Mr. Green obtained sample swabs from the outer edge of the propane tank in question, see Appendix 2, Figures 20, 21, and 22, using the technique previously mentioned. Mr. Green then forwarded those samples on July 10, 2000, to the Forensic Science Agency for examination, by Dr. Murray.

6.2 Laboratory Examination of the Propane Tank

The cotton tip applicator swab sample collected by Mr. Green from the propane tank was examined for the presence of materials of an explosive nature. Dr. Murray did not detect any significant explosive residues on the swabs referred to as being from the propane tank.

6.3 Heat Damage to the Propane Tank

Office of Special Counsel gas dispersion expert, Dr. Jerry Haven, informed us that based upon his review of video, photographs, and analysis, he concluded that the propane tank in question was damaged by a phenomenon called a BLEVE. This phenomenon is caused by a build up of temperature and pressure inside the propane tank from the fire

that caused the tank to explode at its weakest point. The point is generally a welding seam located on the tank.

6.4 Conclusion

It is the opinion of the examiners that an explosive was not used to detonate the exploded propane tank found amongst the debris of the Branch Davidian complex on April 19, 1993. This conclusion is based on the following items;

- (1) The observed damage to the tank is being reported as being consistent with having been BLEVED
- (2) The absence of residues of a high performance explosive on the swabs taken from the tank, whilst not conclusive, indicate that such an explosive had not been used.

7.0 Conclusions

Based on our review of the photo and physical evidence and our micro-chemical analysis of residue taken from the concrete bunker reinforcement bars, the questioned propane tank, and debris inside and on top of the concrete bunker, we conclude that:

- (1) Government agents did not use a shaped charge high explosive device to breach the concrete bunker at the Mount Carmel complex on April 19, 1993; and
- (2) Government agents did not use an explosive device to detonate the exploded propane tank found amongst the debris of the Mount Carmel complex.

Appendix 1 Curriculum Vitaes

Curriculum Vitae of Dr. Gerry Murray

I am a Bachelor of Science (Chemistry), Doctor of Philosophy (Analytical Chemistry), a Chartered Chemist, a Fellow of the Royal Society of Chemistry and a Principal Scientific Officer at the Forensic Science Agency of Northern Ireland.

In December 1973, I joined the Explosives Section of the Northern Ireland Forensic Science Laboratory (now the Forensic Science Agency of Northern Ireland) as a Scientific Officer. I was promoted to Higher Scientific Officer in July 1974, to Senior Scientific Officer in January 1978 and to Principal Scientific Officer in July 1989.

I have almost 27 years experience in forensic explosives investigation concerning all aspects of the terrorist use of explosives in Northern Ireland. This has involved examination of submitted casework materials, analysis of explosives, micro-chemical examinations in relation to explosives residues, examinations of scenes of explosions, many of which were major bombing incidents, evaluation of explosives and devices, preparation of reports and presentation of evidence in court in criminal and civil proceedings in Northern Ireland. I have also given evidence, in relation to terrorist cases, to courts in the Republic of Ireland, Germany and the United States of America and assisted the French authorities in relation to a find of terrorist material in that country.

From December 1995 to April 1997, I was a member of a United States Department of Justice panel set up by the Office of the Inspector General to investigate allegations of misconduct and improper practices within the FBI laboratory in Washington DC.

I have represented my laboratory at national and international conferences in the United Kingdom, the United States of America and France, speaking on various aspects of the terrorist bombing campaign. I have lectured, for a number of years, on forensic explosives investigation to the Higher National Certificate Police Studies course in Northern Ireland and have been involved in the training of Scenes of Crime Officers.

I was appointed an Officer of the Order of the British Empire (OBE) in 1994.

Curriculum Vitae of David A. Green

EDUCATION

Bachelor of Science, Ohio University, Athens, Ohio Forensic Chemistry Major

PROFESSIONAL SEMINARS AND SCHOOLS

GC/FTIR seminar, Hewlett-Packard, Independence, Ohio (1988)

Homicide Investigation, Case Western Reserve Univ., Cleveland, Ohio (1989)

Polarized Light Microscopy, McCrone Research Institute, Chicago, Illinois (1989)

Marijuana Identification, Ohio Peace Officers Training Academy, London, Ohio (1990)

Forensic Microscopy, McCrone Research Institute, Chicago, Illinois (1990)

Chromatographic Methods in Forensic Science, FBI Academy, Quantico, Virginia (1990)

Glass Analysis, Hocking Technical College, Nelsonville, Ohio (1991)

GC Troubleshooting seminar, Hewlett-Packard, Independence, Ohio (1991)

Footwear and Tiretrack Identification, Illinois State Police Lab, Carbondale, Illinois (1991)

Introduction to Hairs and Fiber, FBI Academy, Quantico, Virginia (1992)

International Symposium on Forensic Toxicology, FBI Academy, Quantico, Virginia (1992)

Motor-Vehicle Lamp Examination, Northwest Traffic Institute, Dayton, Ohio (1993)

DEA Forensic Chemist seminar, DEA Special Research and Training, McLean, Virginia (1993)

Advanced Arson Accelerant Detection, BATF workshop, Cincinnati, Ohio (1994)

International Symposium on Shoeprints and Tiretracks, FBI Academy, Quantico, Virginia (1994)

Arson Investigation (level I), Ohio State Fire Marshall's Office, OPOTA, London, Ohio (1994)

Accelerant Detection, BATF workshop, Cleveland, Ohio (1994)

Explosive Analysis, MAFS workshop, Fairview Heights, Illinois (1995)

International Symposium on Arson Investigation, FBI, Fairfax, Virginia (1995)

Steroid Identification and Analysis, Ohio Peace Officers Training Academy, London, Ohio (1995)

International Symposium on Trace Evidence, FBI ,San Antonio, Texas (1996)

Current Technologies in Glass Analysis, MAFS workshop, Dayton, Ohio (1996)

Hit & Run: The Accident Reconstructionist, MAFS workshop, Dayton, Ohio (1996)

Advanced Explosive Analysis, MAFS workshop, Mentor, Ohio (1997)

Instrumental Analysis of Explosives, FBI Academy, Quantico, Virginia (1997)

Microscopy: Paint Pigments, MAFS Workshop, McCrone School, Des Moines, Iowa (1997)

Industrial Trends in Paint and Glass, MAFS Workshop, Ann Arbor, MI (1998)

Post Blast Investigation, MAFS Workshop, Cape Girardeau, MI (1999)

Advanced Fire Debris Analysis, ATF, St. Petersburg, FLA (1999)

EMPLOYMENT HISTORY

June 1989-present

Lake County Regional Forensic Laboratory, Painesville, Ohio

Duties include: Powder and plant material examination, collection and examination of trace evidence material, blood alcohol determination, footwear and tiretrack examination, tool mark impression examination, examination of fire debris, photography, explosive analysis, and crime scene processing.

November 1989-June 1990

Southgate Medical Laboratory

Part time duties included: Urine and blood analysis for drugs and alcohol

ASSOCIATIONS AND MEMBERSHIPS

Member, Midwestern Association of Forensic Scientists

Member, American Academy of Forensic Science

Member, Association of Official Analytical Chemists

Member, International Association for Identification

Member, Canadian Identification Society

Member, Lake County Fire Investigation Unit

Member, Scientific Working Group for Materials Examination

Member, Technical Working Group for Fire and Explosive Examinations

Member, American Society of Testing Materials

Diplomate, American Board of Criminalist

PROFESSIONAL ACTIVITIES

Board Member At Large, 1997-98, MAFS

Training and Education Committee Chair, 1997-98, MAFS

Training and Education Committee member, 1995-97, MAFS

Recording Secretary, Glass Subgroup, 1996-present, SWGMAT

Trace Section Coordinator, 1998-99, MAFS

President Elect, 1999-present, MAFS

Membership Chairman, 1999-present, MAFS

Teaching and Lecturing Experience

Organized numerous professional workshops

Instructed numerous courses for local law enforcement agencies

Lectured for Lakeland Community College on several occasions

Lectured for Ohio Peace Officers Training Academy

Lectured for Ohio State Highway Patrol Academy

Lectured to numerous civic groups, schools, and government agencies

Testified in the following courts

Ashtabula County Common Pleas Court

Lake County Common Pleas Court

Geauga County Common Pleas Court

Cuyahoga County Common Pleas Court

Mahoning County Common Pleas Court

Mentor Municipal Court

Willoughby Municipal Court

Painesville Municipal Court

Shaker Heights Municipal Court

Lyndhurst Municipal Court

South Euclid Municipal Court

Lake County Juvenile Court

Akron Federal Court

Cleveland Federal Court

Appendix 2

Photographs Referenced in Text



Figure 1: The above photograph depicts the questioned hole in the roof of the concrete bunker. Notice the four(4) u-bolts used on the reinforcement bars for safety precautions and the bowing of the reinforcement bars



Figure 2: The above photograph depicts the circular hole in question. Note the shape of the hole, and the reinforcement of the metal bars.



Figure 3: The above photograph depicts the circular hole located in the center of the bunker as well as several other hole located in the roof and their proximity to one another.



Figure 4: The above photograph depicts holes located in the roof of the concrete bunker. These holes occurred at the edge of the roof, several feet from the circular hole located in the center of the bunker roof (which can also be observed in figure 3).



Figure 5: The above photograph depicts the ceiling region inside the bunker. Note the pieces of concrete missing, due in part to the spalling phenomenon. Also note that several large holes are present in the ceiling, not just a single circular hole in the center area of the roof.

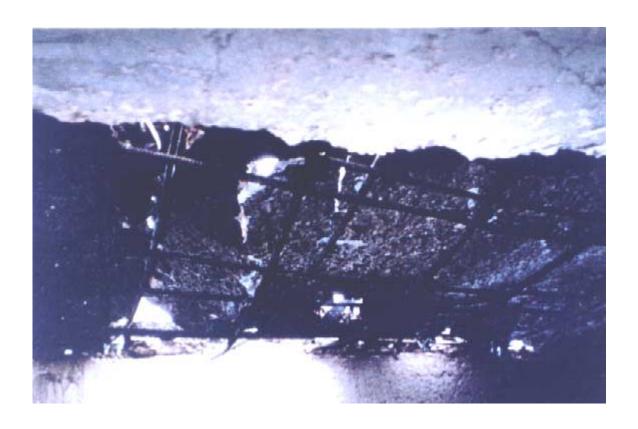


Figure 6: The above photograph depicts the ceiling region inside the bunker. Note the pieces of concrete missing, due in part to the spalling phenomenon. Also note that several holes are present in the ceiling, not just single circular hole in the center area of the roof.



Figure 7: The above photograph depicts the extreme damage to the concrete on the ceiling of he bunker. Notice the "bowing of the ceiling and the pieces of concrete missing from the underside of the reinforcement bars.

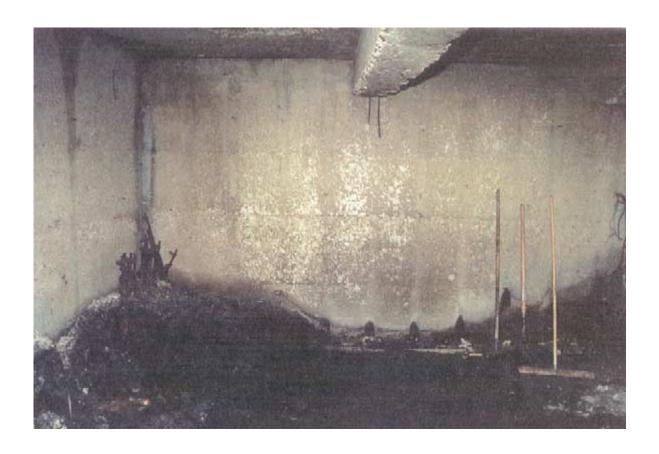


Figure 8: The above photograph again depicts the condition of the inside of the concrete, which constructed the bunker. Notice the pitting (missing pieces) on the concrete walls as well as the concrete beam in the ceiling.



Figure 9: The above photograph depicts the overhead view of the concrete bunker. Notice the hole in the "center" of the bunker, along with the second circular mark at the 4 o'clock area.

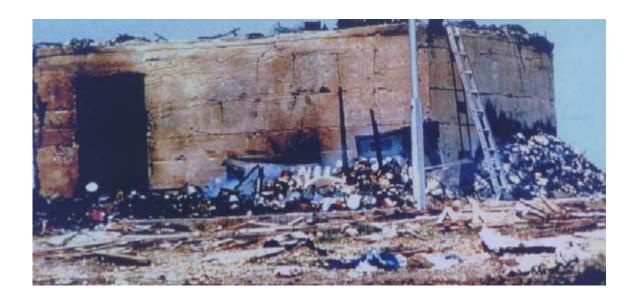


Figure 10: The above photograph depicts the front and side of the concrete bunker. Note the condition of the walls of the structure, specifically, the cracks and pitted areas located all over the outside walls.



Figure 11: This photo depicts the back of the concrete bunker, note the condition of the concrete on the walls, with regard to cracks and pitting.



Figure 12: The above photo depicts the condition of the concrete bunker from the front side. Notice the cracks and pitting on the outside surface. There is enough space in front of the doorway to allow several men to work.



Figure 13: The photograph depicts the inside of the concrete bunker. Note the "bowing" of the concrete ceiling, the pitting or spalling of the concrete ceiling beams, the condition of the metal object along the wall. Notice the metal object, or cooler, is not directly under the hole in the center of the bunker roof.

TOWER COLLAPSE AND PROPANE TANK EXPLOSION (ELAPSED TIME IN SECONDS)



Figure 14: The above series of photographs depicts still photographs created from video. The first frame exhibits the tower collapsing, from the fire, the next three frames depicts the fire burning as time elapses to the 7 minute 58 second mark, when a fireball explosion can be observed.



Figure 15: The photograph depicts the destruction of the concrete bunker. According to statements this was conducted due to the visibly and physically unsafe nature of the bunkers condition.



Figure 16: This photograph depicts pieces of grenade fragments which were collected from the roof of the concrete bunker.



Figure 17: This photograph depicts the masks that were "swabbed" by Mr. Green. The masks were labelled as having been collected from inside the bunker.





Figure 18: The lower photograph depicts a close view of grenade fragment. The top photograph depicts the grenade igniter set referenced in section 5.6 of this report.



Figure 19: This photograph depicts the reinforcement bars, which were tested for the presence of explosive residues.

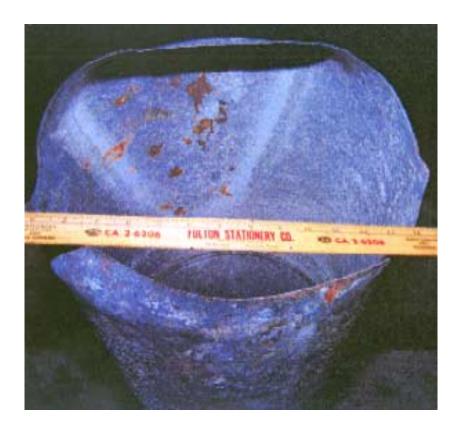


Figure 20: The above photograph exhibits a view of the damaged edge of the questioned propane tank.

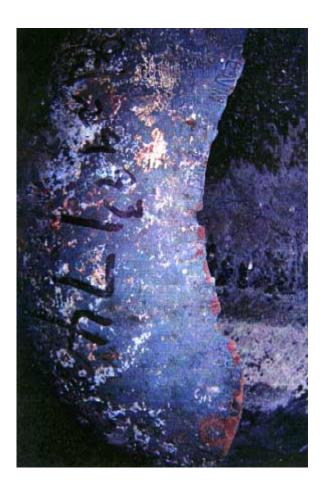


Figure 21: The above photograph depicts a close view of the edge of the questioned propane tank. This area was the region that was "swabbed" by Mr. Green.

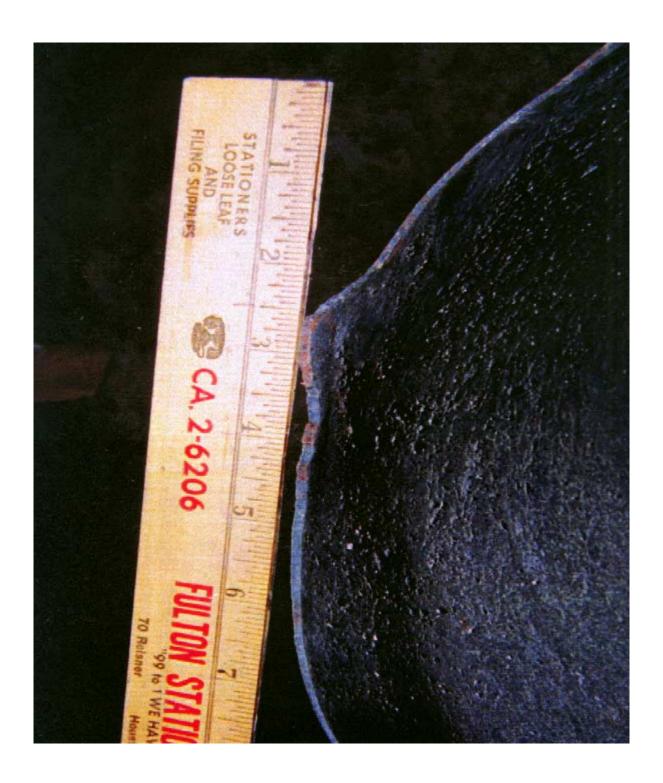


Figure 22: The above photograph depicts a close view of the edge of the propane tank